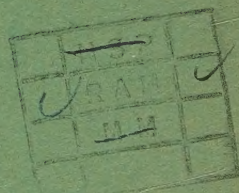




NORTHERN REGION OF NIGERIA

**Annual Report on the Department
of Agriculture of the Northern
Region of Nigeria
1954-55**

GOVERNMENT PRINTER, KADUNA



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of the Northern Region of Nigeria
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REPORT OF THE DEPARTMENT OF AGRICULTURE, NORTHERN REGION—1954-55

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REPORT OF THE DEPARTMENT OF AGRICULTURE NORTHERN REGION, 1954-55

1. *Staff and General.*—There is no doubt that the limiting factor in Agricultural Development, on which the general progress of the Northern Region ultimately depends, is the shortage of staff, particularly trained and experienced staff. During the year there was no appreciable improvement in the Senior Service position and, had it not been for the assistance of the Production Division of some thirty-eight Production Officers financed by the Northern Regional Production and Development Board (N.R.P.D.B.), much of the work at present being attempted could not have been started. The Junior Staff position deteriorated largely on account of political developments, with a net reduction of thirty-eight officers; and the disappointing intake of students to the 1955 Agricultural Assistants' Class at the Samaru School of Agriculture, does not point too hopefully to the future.

It should not be forgotten that much direct agricultural work now devolves directly upon the Native Administration agricultural departments; and here again the general standard of education and technical ability of the staff is far too low to cope with the rapid development which the times demand.

Another factor which aggravates this unsatisfactory state of affairs is the ever increasing volume of routine office and administrative work which at present tends inevitably to fall to the more senior and experienced officers and which directs their energies more and more from the technical advisory and supervisory work which they should be doing.

A summary of the establishment apart from staff posts is given below:—

SENIOR SERVICE

<i>Post</i>	<i>Establishment</i>	<i>No.</i>	<i>No.</i>	<i>Vacancies</i>
	1/4/54- 31/3/55	1-4-54	31-3-55	as at 31-3-55
Senior Agricultural Officers	10	5	4	6
Agricultural Officers ..	33	13	18	15
Agricultural Superintendents	22	12	10	12
Agricultural Development Officers ..	13	5	3	10
Irrigation Engineers ..	11	7	8	3
Agricultural Engineers	3	3	3	—
Mechanical Demonstrators	10	9	8	2
Specialist Officers ..	26	5	6	20
<i>Total</i>	128	59	60	68

JUNIOR SERVICE

<i>Post</i>	<i>Establish- ment 1/4/54- 31/3/55</i>	<i>No. 1-4-54</i>	<i>No. 31-3-55</i>	<i>Vacancies as at 31-3-55</i>
Assistant Agricultural Officers, Grade I	10	9	8	2
Assistant Agricultural Officers, Grades II and III .. .	25	18	17	8
Senior Agricultural Assistants ..	9	9	9	—
Agricultural Assistant, Grade I ..	27	12	17	10
Agricultural Assistants, Grades II and III	238	163	121	117
Irrigation Surveyors, Grades II and III	16	7	7	9
Irrigation Overseers, Grades I and II	40	27	27	13
Field Overseers, Grades I and II	157	119	120	37
<i>Total</i>	522	464	426	196

2. *Organisation.*—Mr P. C. Chambers, Director of Agriculture, was in charge of the Department until he went on leave on the 14th of March when Mr M. W. Gibbon took over as Acting Director.

The Production Division financed by Northern Regional Production and Development Board continued to act to all intents and purposes as part of the Agricultural Department under the control of the Director of Agriculture. It was hoped to bring the Division, which had increased to thirty-eight Production Officers as against twenty-five in the previous year, into the Regional establishment before the end of the year but this move had to be postponed temporarily.

Much thought was given to the reorganisation of staff and responsibilities within the Provinces to keep pace with the speeding up of development both agricultural and political; and it is now intended inter alia to strengthen the staffing at Divisional level as and when the availability of qualified and experienced staff permits.

3. *The Season.*—By and large 1954 was a very good year for farmers and almost without exception, crops were above average. Admittedly, there was a sharp drop in the tonnage of groundnuts bought for export but this was a result of reduced acreage rather than adverse weather conditions. Not only was the total rainfall considerably above average in almost all Provinces but, more important, distribution was on the whole very good. Excellent early rains enabled crops to be planted in good time in spite of the disruption caused by the fast of Ramadan occurring during

the month of May; and good late rains helped to fill out the cereal crops and provide a bumper cotton crop. However, weather can never be perfect for farmers. Thus the heavy rains which provided good crops on the lighter soils did a certain amount of damage by waterlogging and flooding on the lower lying areas and the dry spell in June which ensured an excellent crop of Bennisseed in Benue caused a good deal of replanting of corn in Sokoto and Katsina.

Typical rainfall records are as follows:—

NORTHERN BELT

Province Station	SOKOTO Sokoto		ZARIA Samaru		KANO Kano		BORNU Maiduguri	
	1954	Average 22 years	1954	Average 31 years	1954	Average 28 years	1954	Average 38 years
January	—	—	—	—	—	—	—	0.01
February	0.01	—	0.48	0.06	0.06	0.01	—	—
March... ..	—	0.02	3.11	0.39	—	0.07	0.39	0.02
April	0.28	0.41	2.55	1.24	1.02	0.41	1.25	0.27
May	2.07	1.95	8.65	5.43	4.86	2.74	1.85	1.61
June	1.10	2.89	6.16	6.36	4.78	4.18	6.95	2.80
July	7.78	6.56	6.61	8.78	13.53	8.38	6.36	6.96
August	18.52	11.06	16.42	11.87	18.41	11.92	7.17	8.72
September	2.35	5.20	12.32	8.67	3.77	3.40	2.48	4.19
October	0.26	0.51	1.28	1.35	2.65	0.69	0.98	0.74
November	0.10	—	0.76	0.05	0.01	0.04	0.02	0.01
December	—	—	—	0.01	—	—	—	—
	32.47	28.60	58.34	44.20	49.18	31.84	27.45	25.33

SOUTHERN BELT

Province Station	PLATEAU Riyom		NIGER Bida		BENUE Yandev		ILORIN Ilorin	
	1954	Average 13 years	1954	Average 19 years	1954	Average 28 years	1954	Average 50 years
January	—	0.02	—	—	—	0.28	0.17	0.27
February	0.30	0.38	—	0.26	0.73	0.68	0.70	0.65
March	3.24	1.14	1.08	1.20	2.84	1.41	3.39	2.22
April	9.89	3.72	6.56	2.55	6.62	4.00	8.21	4.15
May	8.37	6.97	5.65	6.09	10.47	7.28	7.58	6.72
June	11.82	8.96	4.40	6.77	5.97	7.69	8.42	7.66
July	11.43	9.18	4.88	7.41	2.65	5.35	1.58	5.51
August	11.42	12.24	9.84	8.48	5.86	6.53	5.27	4.85
September	8.54	8.95	7.05	9.33	8.31	10.68	8.27	9.56
October	1.47	2.58	5.04	3.89	10.53	8.99	10.85	6.93
November	0.16	0.13	—	0.32	1.29	0.57	0.77	1.15
December	—	0.10	—	0.01	—	0.15	—	0.32
	66.64	54.37	44.50	46.31	55.27	53.61	55.21	49.99

4. *Food Supplies and Prices.*—Before the 1954 main crops began to come on to the market, food prices were very high due to:

(a) the partial failure of the 1953 grain crops in the more northerly Provinces and:

(b) the willingness of traders from the Western and Eastern Regions to pay high prices for their supplies.

During this period there is no doubt that the lower income groups such as Daily Paid Labourers suffered considerable hardship. The good 1954 crops, however, brought prices back to a reasonable level although not, be it noted, to the relatively low levels of 1952 and 1953.

During the period of food scarcity the Guineacorn and Yam growing Provinces of the Riverain areas came to the rescue of their more Northernly neighbours and there was a considerable movement of food from South to North of the Region.

5. *Food Crops*.—In contrast to the disappointing yields of 1953 and subsequent hardship caused by the scarcity and expense of food in the markets, all food crops in 1954 were, in general, excellent. In addition to increased yields there was a marked increase in the acreage devoted to staple foods, and there should be no shortage of food in 1955.

Guineacorn was a very good crop throughout the region on a somewhat increased acreage. In most areas *Millet*s did well on an increased acreage but in some areas, notably Katsina, the dry spells came at the wrong time and spoilt the crop. *Maize* was in general a good crop with less rust damage than usual due to earlier planting and *Yams* did very well in all the main yam areas. *Cassava* is becoming more popular and more widely grown and *Sweet Potatoes* and *Acha* also had a very good year.

6. *Quantity and value of Export Crops*.—Below are given the tonnages bought of the principal export crops and their approximate value to the producers. As will be seen, the drop in the value of the Groundnut crop is largely balanced by the increased in the Cotton crop.

Group	Tonnage Purchased for Export		
	1952-53	1953-54	1954-55
Groundnuts	430,696	424,662	374,627
Seed Cotton	48,244	71,876	97,724
Benniseed	13,501	13,447	15,627
Soya Beans	3,899	8,731	8,704
Crop	Value to the Producer (£)		
	1952-53	1953-54	1954-55
Groundnuts	15,504,056	15,287,838	13,486,572
Seed Cotton	2,653,819	3,966,035	5,277,096
Benniseed	486,036	484,092	562,572
Soya Beans	77,980	174,620	174,080
Total	18,721,891	19,912,579	19,500,320

7. *Mixed Farming*.—Satisfactory progress was made during the year. Steady expansion has been continued—total numbers show a net increase of 1,136—and there has been much consolidation by way of clearing up of outstanding advances. In Katsina for example the total outstanding advances were reduced by 60 per cent. A sign of the times is the readiness with which farmers now purchase their own cattle. There is much to be said for this, as although the Departmental staff thus lose direct control over the farmer and his farming methods, these same staff are released from the time-consuming and profitless work of dealing with advance accounts and are therefore better able to get out into the bush and see what is going on. Another notable development in Katsina is the issue of sixty-four cows to farmers, with which it is hoped they will breed their own replacements.

Disease, of course, has prevented or retarded progress in many Provinces, for instance trypanosomiasis in Zaria and the Riverain Provinces, Pleuropneumonia in Bornu and Rinderpest in Kano; but the cattle on the Kontagora Land Settlement Scheme have continued to thrive in the midst of a very bad tsetse area through the use of Antrycide Prosalt.

NUMBERS OF MIXED FARMERS DURING THE LAST SIX YEARS

Year			Number started during the year	Failures during the year	Total at end of year
1949	..	..	1,342	299	5,763
1950	..	..	1,577	288	7,052
1951	..	..	2,306	517	8,841
1952	..	..	2,869	766	10,943
1953	..	..	1,688	867	11,625
1954	..	..	1,959	823	12,761

8. *Cattle Multiplication Centres*.—Further progress was made with the establishment of the eleven Centres so far decided upon and with the solution of the many problems inevitably arising out of the establishment of new farms and new herds of cattle. In Sokoto Province the herd at Dogondaji had to be cleared out because of an outbreak of pleuro-pneumonia but at Kotorkoshi and Talata Mafara, successful multiplication took place. Marguba (Bornu) was stocked with Shuwas, at Birnin Kudu, Gumel in Kano Province and Kabomo in Katsina, a start was made on establishing the multiplication herds. At Anchau (Zaria) progress was nullified by a heavy attack of trypanosomiasis at the end of the rains, causing heavy losses of calves. At Darazo and Tumu (Bauchi) the buildings were completed but progress at Kukar Aljanna (Katsina) was held up by water supply troubles.

9. *Shika Stock Farm: (a) Cattle*.—The herd was reduced from 702 to 639 head, largely due to the transfer of ninety-five animals to Cattle Multiplication Centres and other stations.

In spite of the fact that there was no serious outbreak of disease amongst the cattle, a disappointing year was nevertheless experienced. There was a sharp increase in the mortality of calves up to six months old—from 21.2 per cent to 29.7 per cent in the case of White Fulanis and from 15.8 per cent to the alarming figure of 37.1 per cent amongst the Sokotos—and between weaning at six months old and twelve months a further seventeen were lost due to anaemia. It was noticed that two anaemic calves responded markedly to iron treatment.

As shown in the following table, milk yields, if not increasing, had at least remained steady during the previous three years, showed a sharp decline of 10 per cent for White Fulanis and nearly 15 per cent for Sokotos.

YIELD AVERAGE (LBS)

				<i>White Fulani</i>	<i>Sokoto</i>
1951-52	..	..	..	2,788	2,723
1952-53	..	..	..	2,577	2,732
1953-54	..	..	..	2,639	2,771
1954-55	..	..	..	2,366	2,366

The best lactation was 4,527 lbs in 305 days by W.F. cow No. 594; but the fall in milk yields is further emphasised by the 60 per cent reduction in lactations exceeding 3,200 lbs.

<i>White Fulani</i>				<i>Sokoto</i>		
	<i>Full-time lactations</i>	<i>No. exceedings 3,200 lbs.</i>	<i>Percentage</i>	<i>Full-time lactations</i>	<i>No. exceedings 32,00 lbs.</i>	<i>Percentage</i>
1952-53	35	25	71.4	16	13	81.3
1953-54	38	24	63.2	12	12	100
1954-55	38	9	23.7	17	4	23.5

Regular Antrycide Prosalt inoculations, started in November 1953, were continued and the interval between inoculations was reduced to two months. This treatment, in conjunction with the clearance of a further 301 acres of bush, effectively reduced the trypanosomiasis mortality from twenty-two in 1953-54 to only one in 1954-55. It is thought, however, that these frequent inoculations may have been contributory to the fall in milk yields.

A summary of the herd records for the year is shown in Appendix I.

(b) *Pigs*.—The main feature of the year was the collapse of the Lagos Cold Store market for fat pigs and the subsequent necessity of selling the pigs locally and attempting to reduce the herd to a small breeding herd.

The following figures show a continuation of the tendency commented on in last year's report of the non-pure herds to produce better weaned litters than the pure breeds:—

	No. of Litters	Average No. born per Litter	Average No. weaned per Litter	Average weight at Birth	Average weight at weaning
Pure Bred	6	12.33	7.66	2.90 lbs	26.62 lbs
Non-pure Bred ...	19	10.37	8.26	2.93 lbs	28.26 lbs

(c) *Crops*.—Rainfall was well above average. Guineacorn averaging 2,631 lbs threshed grain per acre, was slightly down on the previous year (2,675) and Mucuna hay yielded only 5,014 lbs per acre compared to the previous figure of 6,299 lbs, but the quality was good.

10. *Daudawa Beef Herd*.—This herd is still struggling to re-establish itself after the vicissitudes it has suffered during the past three years. There was no serious outbreak of disease during the year although deaths were equal in number to births. Severe culling reduced the numbers from 276 to 142 head of reasonably good stock.

11. *Shuwa and Adamawa Herds*.—The Shuwa herd of about 140 animals kept in excellent health throughout the year and an interesting stage of the selective breeding scheme was reached when the first heifers sired by farm bred bulls began to calve. Twenty lactations were completed averaging 3,723.7 lbs per lactation. The highest yielder was cow No. F. 170 with 6,834.0 lbs in 305 days in her first lactation and eleven lactations exceeded 3,200 lbs.

The Adamawa herd, though not producing such spectacular results as the foregoing, kept in good condition and the average milk yield improved from last year's average of only 1,699 lbs per lactation to the more respectable figure of 2,341 lbs per lactation. The highest yielder was cow No. 42 with 3,454 lbs but she was the only one to exceed 3,200 lbs.

12. *Cattle in Tsetse Country*.—The performance of the Ndama Multiplication herd at Raav (Benue) is still unsatisfactory. It is now being kept under improved conditions of housing and feeding and during the rainy season it thrived, but towards the end of the rains the animals again fell away in condition and several of the twenty-four young bulls brought to Raav from Fashola in August became affected with tryps.

The policy of issuing Ndama bulls on loan to farmers with Muturu cattle for crossing and eventual upgrading of the local breed to Ndama was continued. The first cross calves so far produced are proving popular and increasing the interest of the farmers in the scheme.

13. *Poultry*.—After lying empty for a year in order to eradicate disease, poultry work was resumed at the Riyom breeding centre by the introduction of 500 R.I.R. Day Old Chiks in May by air from the United Kingdom.

Subsequently further importations were made of R.I.R. x Light Sussex Cockerels and of Pure R.I.R. Cockerels and pullets. Rearing was successful and, after keeping selected birds for a small breeding flock, surplus birds were distributed. There was no serious outbreak of disease.

In all Provinces schemes have now been established for the production and distribution to famers of exotic x local poultry and eggs.

14. *Groundnuts*.—Comparative figures for purchases (tons) by Provinces are as below:

<i>Province</i>	1951-52	1952-53	1953-54	1954-55
Kano	220,934	217,982	223,054	183,334
Katsina	63,727	66,815	59,084	54,214
Sokoto	42,610	48,199	46,893	34,423
Bornu	48,215	51,002	62,071	64,592
Bauchi	17,964	16,741	9,772	10,588
Adamawa	14,219	15,717	11,599	13,821
Zaria	5,300	7,816	6,171	6,630
Plateau	—	4,029	4,242	5,811
Other Provinces	5,286	2,395	1,726	1,214
	418,255	430,696	424,612	374,627

The 11.8 per cent reduction in the tonnage bought mainly occurred in Kano, Sokoto and Katsina Provinces. Although the dry weather in June to some extent interfered with germination the weather was, on the whole, very favourable to the crop. The main reason for the reduction is undoubtedly to be found in the fact that a much reduced acreage was planted in the Northern areas due to the shortage and high cost of seed at planting time. This was itself the result of the general scarcity and dearth of food in the markets and the tendency for crops reserved for seed to be consumed instead. In some areas part of the crop itself was raised early and consumed as food until the Guineacorn harvest relieved the situation.

The Dambarta Scheme for the Multiplication and distribution of the Botanist's K.50 selections was continued and it is estimated that some 30-40 per cent of the farmers in Dambarta District are now using K.50 seed.

15. *Cotton*.—The cotton crop is still expanding and this year's purchases were an easy record showing an increase of no less than 30 per cent over the crop of 1953-54 which was itself a record.

TOTAL PURCHASES OF SEED COTTON (TONS)

1948-49	1949-50	1950-51	1951-52	1952-53	1953-54	1954-55
25,316	31,417	40,862	60,748	48,244	75,366	97,724

PURCHASES OF SEED COTTON (TONS) IN THE MAIN PRODUCING PROVINCES

	1953-54	1954-55
Katsina	22,957	33,130
Sokoto	24,174	27,056
Zaria	10,192	13,324
Bauchi	6,818	10,146
Niger	3,345	4,435
Kano	1,795	3,040

Although there was undoubtedly a substantial increase in the acreage devoted to cotton as indicated in the table of cotton seed issued there is no doubt that much of the increase in the crop was due to a combination of suitable weather particularly the good late rains, a relatively low incidence of disease and, not least, better farming methods, largely the result of persistent propaganda by the extension staff of the Department.

COTTON SEED ISSUED IN TONS 1950-54 (SAMARU 26C ONLY)

<i>Province</i>	1950	1951	1952	1953	1954
Adamawa ..	22	31	100	338½	575
Bauchi ..	550	867	1,208	1,403	1,454
Benue ..	60	30	42	52	140
Bornu ..	24	32	78½	130	179
Ilorin ..	—	—	1	7	20
Kano ..	498	585	747	785	795
Katsina ..	3,315	3,828	4,224½	4,138	4,264½
Niger ..	539	610	628	678	774
Plateau ..	103	124	139½	227	310
Sokoto ..	2,856	3,358	3,910½	3,876	3,825
Zaria ..	1,508	1,622½	1,845½	1,954	2,085
Total ..	9,475	11,087½	12,924½	13,588½	14,421½

Grading is by no means uniform or reliable and there is no doubt that there is much room for improvement in the quality of seed cotton purchased.

PERCENTAGE OF GRADE BOUGHT

<i>Grade</i>	1953-54	1954-55
N.A. I.	71.1	63.5
N.A. II	19.9	27.4
N.A. III	9.0	9.0

Great efforts have been made to reduce the disease factor by enforcing the three months close season; but for a variety of reasons, including lack of interest by N.A. Staff, difficulty of inspecting wide areas and the small

finest imposed having little deterrent value; these efforts have so far met with only limited success.

Multiplication of the various stages of strain 26C was continued in the Daudawa area and there is no doubt that the provision of better seed to the whole Allen area is playing an important part in increasing yields.

The Cotton Breeder's new selection, 479-25, gave outstanding results when grown over a substantial area at Samaru, giving a yield of 1,150 lbs per acre seed cotton which is exceptional for Nigeria. It is now proposed to go ahead with the multiplication of this strain and it is thought that enough seed has already been obtained to plant Stage C in the Daudawa Multiplication Scheme, thus cutting out the twenty acre Stage B and gaining a season in time.

16. *Rice*.—This crop is coming more into the limelight as its popularity grows and as more and more of the enormous tracts of fadama land in the Northern Region are utilised for growing the crop. 1954 saw a substantial increase in acreage in most areas and although there was some localised field damage, yields were, in general, better than usual due to the good October rains. The Department continued to encourage the growing of the crop by Irrigation Schemes, by assisting in the multiplication and distribution of improved seeds, and by organising ploughing and cultivation of fadamas notably at Shemankar (Plateau), Jere (Bornu) Akiri (Benue), in Kano and in Northern Zaria. There is no doubt of the popularity of this work with the farmers. Although it is very difficult to make schemes pay when organised by Government or Native Authorities, even after charging the relatively high price of 50s per acre for ploughing, there seems no doubt that there is a future for mechanical cultivation of fadamas particularly, when, in due course, the farmers become sufficiently mechanically competent to own and work their own tractors.

The Federal Rice Research Station at Badeggi was at last built and brought into limited operation. It is hoped that there will now be no further delay in setting in motion the long overdue experimental work required to be done on this crop.

17. *Sugar*.—Red Rot disease again interfered with the crop in the main areas. In Sokoto it was thought that the considerable flooding accentuated the disease and brown sugar production in that area fell from 930 tons in 1953 to 829 tons in 1954. In the Zaria area Red Rot caused heavy losses in the older cane. In all areas the high price obtainable for chewing cane resulted in a reduction in the amount of cane crushed, as brown sugar production tended to become uneconomical in competition with imported sugar.

At Maigana a further six new varieties provided by the Botanist showed a marked and promising degree of resistance to Red Rot disease when compared with the local variety and it is hoped soon to find resistant varieties acceptable to the local people for chewing and crushing.

18. *Virginia Tobacco*.—During the year the policy was to try and consolidate the existing crop in Zaria, Kano and Sokoto Provinces by improving yields and quality rather than to attempt any further major expansion. Small crops were grown in other areas, particularly on the Benue fadamas.

Weather conditions were very favourable and, on a slightly increased acreage, a final crop almost double that of 1953 was expected.

Fertiliser trials were carried out at Gusau, and variety trials, to test the performance of some new introduced varieties against the Virginia hybrid commonly grown in the North, were laid down at Samaru. Due to delays in curing, results cannot be given, but the crop at Samaru was the best for many years and is expected to yield 1,000 lbs cured leaf from 1.5 acres.

19. *Soya Beans*.—The good season benefitted Soya Beans as most other crops. In Benue, the main growing area, a good tonnage was again bought for export and the crop has now become firmly established in the local economy. In Abuja Division of Niger Province the crop expanded further from 84 tons in 1953-54 to 115 tons in 1954-55.

Total purchases for export during the past five years are as follows:—

<i>Year</i>						<i>Purchases</i> (tons)	<i>Price</i> (£ per ton)
1950-51	..	..	..	..	..	3,510	19
1951-52	..	..	..	..	..	8,035	20
1952-53	..	..	..	..	..	3,892	20
1953-54	..	..	..	..	..	8,731	20
1954-55	..	..	..	..	..	8,704	20

20. *Benniseed*.—Excellent early rains and the dry weather in June suited the Benue crop very well and the tonnage for export was the second highest ever purchased. The good late rains also suited the end of the season crop in Abuja and the Plateau area.

<i>Year</i>						<i>Purchase for</i> <i>Export (tons)</i>	<i>Price</i> <i>per ton</i> £
1950-51	..	..	..	..	..	9,188	19-20
1951-52	..	..	..	..	..	10,387	32
1952-53	..	..	..	..	..	13,375	36
1953-54	..	..	..	..	..	13,447	36
1954-55	..	..	..	..	..	15,627	36

At Yandev selection from local seed for earliness and higher yield was continued. Some of the selections are quite promising and seem to be an improvement on unselected seed.

21. *Ginger*.—Although there are now no gazetted markets for this crop it is still fairly widely grown in Southern Zaria and Jema'a and disposed of in the local markets, as well as to dealers for export.

22. *Peppers*.—The Capsicum trade is a tricky one and its production is therefore risky. Nevertheless the crop continues to be popular in the Lemu District of Niger Province where out of about 120 tons of Capsicums produced, 75 tons were bought for export against 50 tons in 1953.

23. *Oil Palms*.—As the staff position in the Provinces improves with the posting of more Production Officers, it is becoming possible to give more attention to the development of this crop through the establishment of plantations of improved palms, work which requires constant and careful supervision. The establishment of large areas of improved oil palms in the vicinity of the three Pioneer Oil Mills in Kabba has been continued and so far 376 acres have been planted. Small pilot plantations have been started in Benue and Niger and it is hoped to eventually obtain sufficient concentrations of high yielding palms in these areas to justify the establishment of Pioneer Oil Mills. The inability of either the Eastern or Western Regions to supply improved seedlings during the year was disappointing but arrangements were made for the establishment of germinators at Yandev and Ilorin so that this Region can produce its own.

Palm produce bought for export in the Northern Region during the past four years is as follows:—

	1951-52	1952-53	1953-54	1954-55
Palm Kernels (tons) ..	7,910	10,113	10,294	11,076
Palm Oil (tons) ..	340	1,419	2,086	1,902

24. *Fruit Trees*.—There is always a good demand for fruit trees and all stations, including those such as Yandev and Ilorin that have had large nurseries for some years, had no difficulty in finding a market for their trees. The following are the approximate numbers of trees distributed during the year from all stations:—

Budded citrus	13,049
Budded Mango	6,705
Others (mostly Guava) ..	26,310
Total	46,064

Fruit growing continues to be popular in Maiduguri and several growers are now establishing their own Mango nurseries. Samples of Maiduguri mangoes were sent to Kano for canning tests and results, particularly with the variety Maiduguri Peter, were very encouraging.

25. *Coffee*.—Encouraged by the good results and high prices obtained by coffee-growers in the Bamenda area, some ninety farmers have now started growing Arabica coffee on the Mambila Plateau in Adamawa and

their prospects of success seem to be promising. The success of a few bushes of Robusta coffee at Oturkpo in Benue Province, has raised hopes of growing that crop successfully in that Province. There was an increase in the acreage planted to Robusta coffee in Kabba Province.

26. *Cocoa*.—During the year some 374 tons, including 322 tons main crop and 52 tons light crop, were bought for export in the Northern Region. Almost all of this came from Kabba and Ilorin Provinces. The high prices lately ruling for this crop have naturally provoked great interest in any areas where it is thought it might conceivably grow. But outside Kabba and Ilorin it is almost certain that such areas are confined to relatively small pockets of Kurmi in Benue and Niger Provinces, and even in these places, conditions of climate and soil may not be good enough.

27. *Pasture Work*.—The acquisition of a Pasture Research Officer has enabled more attention to be paid to this important subject. Pasture work of one sort or another is now being carried out at most stations and, although no very spectacular results have yet been obtained, it seems that a combination of suitable species of grasses, controlled grazing and a dressing of superphosphate can give quite a good and durable pasture which is of benefit to the ensuing crops.

28. *Locusts*.—Swarms of desert locusts entered Bornu from French Niger Colony in early August and laid eggs over a wide area along the shores of Lake Chad. Energetic action was taken against the resulting hopper bands with Agrocide bait and other measures. Over 400, about 90 per cent of the hopper bands, were destroyed and the danger was brought under control.

29. *Fertiliser*.—The Fertiliser Scheme, although still in a good deal of confusion, now shows signs of settling down to a definite line of steady progress. To persuade the average Nigerian peasant to use manure, let alone pay for it, is no easy matter. Nevertheless, in those areas where the need of manure is most pressing, that is in areas where the land is either very scarce as in Northern Katsina or very poor, there is no doubt that the farmers are beginning to see that it pays to apply manure and are buying it more willingly.

During the year a Production Officer was given the task of co-ordinating the fertiliser campaign in the main fertiliser Provinces and this led to a great improvement in the organisation. He has now made proposals for a reorganisation of the campaign on sounder lines in view of the experience gained during the past few years, with the ultimate object of passing the sales of fertiliser from the Department to the more appropriate hands of the Commercial Firms and Village Traders. All this, of course, will take time.

The following figures show the change in policy from free issues to sales:—

<i>Year</i>						<i>Free Issues</i> ($\frac{1}{2}$ cwt. bags)	<i>Sales</i> ($\frac{1}{2}$ cwt. bags)
1950	...	...	...	...	...	30,000	—
1951	...	...	...	...	...	67,000	25,000
1952	...	...	...	...	...	32,000	22,000
1953	...	...	...	...	...	100	(?)44,000 (27,000)
1954	...	...	...	...	...	54	26,000

Note.—The sales figure for 1953 previously given as 44,000 bags, is doubtful and is now thought to be nearer 27,000. There was some confusion in 1953 when the whole campaign was taken over by this Department.

Approximate sales by Provinces during the past four years are given below—(again there is some doubt about the 1953 figures).

<i>Province</i>				$\frac{1}{2}$ cwt. bags sold			
				1951	1952	1953	1954
Adamawa	...	...	...	205	200	240	1,040
Bauchi	...	...	...	2,245	4,381	4,900	2,130
Bornu...	...	...	...	3,375	3,160	1,374	513
Kano	...	...	...	2,348	3,815	3,621	3,380
Katsina	...	...	...	581	2,926	14,998	13,851
Sokoto	...	...	...	15,851	7,600	18,933	4,715
Zaria	...	...	...	344	1	6	350
Niger	...	...	...	—	—	120	78
Total	...	...	...	24,949	22,083	(?)44,193	26,057
(27,073)							

30. *Mechanisation.*—The Engineering Branch had a busy year looking after existing equipment and trying to obtain or make new equipment suitable to Northern Nigerian conditions. There are now some 158 tractors operating in the North, (including forty-four track layers) of which ninety-eight belong to the Department.

The main effort has again been devoted to fadama work where there seems to be little doubt that tractor farming is an economic proposition, mainly because of the reasonably high cash yield per acre of rice. In almost every Province fadama ploughing has been carried out more or less successfully and it has always been in demand by the farmers. For instance the Tractor Hiring Unit operating from Samaru has concentrated almost entirely on fadama this year instead of upland cultivation with great success and it is thought that this sort of work can now pass from the experimental to the commercial stage.

Investigations were carried out on the Sokoto fadamas to try and find lighter and cheaper equipment to replace the heavy and expensive D 7 Caterpillars and Heavy Davis Disc Ploughs at present employed. It was found that the D 4 and Light Davis Disc plough were a satisfactory combination under all conditions. It was noticed that a D 4 and Duratrac Mould-board plough gave good results at Jere (Bornu).

Upland investigational work was continued on the Tractor Farms at Daudawa (Katsina) and Mbatie (Benue) with inconclusive results. Out of a fairly wide range of crops grown on these two farms only Guineacorn at Daudawa and Yams at Mbatie proved profitable, and this in a year of peak crops and peak prices. It has to be remembered, of course, that under Government Management overheads, such as expatriate supervision, tend to be very high and at Mbatie at least the soil is, on the whole, poor. It is proving almost impossible to get a cash yield from upland crops on these rather thin soils sufficient to carry the heavy running expenditure inevitably associated with machinery in this country.

At Darazo Cattle Multiplication Centre an earth dam 275 yards long by 18 feet at greatest height was largely completed. This is the first sizable dam of this sort to be made by mechanical means and may be the precursor of many in the dry North.

At Samaru trials were carried out on the following different types of Groundnut Decortication Equipment:—

- (a) French "Samat"
- (b) American "Turner"
- (c) Indian "Kirlokar" (hand model-power driven)
- (d) Three types of hand operated machines.

A considerable amount of useful and interesting information was obtained but it is considered necessary to test further these and any other new machines which may come to hand, before conclusions can be reached.

31. *Soil Conservation*.—Further progress was made on several schemes. In Kano Province at Badume, controlled grazing of the reclaimed area by local Fulani proved successful and at Kiru Resettlement Scheme, further contour bunding was carried out. Farmers were encouraged to plant grasses in the contour bunds through their farms. These bunds were previously ploughed. Gamba *Andropogon Gayanus* and Jema grass *Vetiveria Nigritana* were used. These efforts were generally successful.

In Plateau, work continued at Langtang and the conserved area now covers some five square miles. Unusually heavy rains caused some damage to existing works but this was repaired. In the Mubi District of Adamawa, farmers were encouraged to construct stone terraces, as they did in by-gone days, by having the contours marked out for them.

At Mokwa, the Engineering Branch relaid on graded contour some 1,200 acres of land from which it was expected that about 750 acres would be available for mechanical ploughing.

32. *Irrigation*.—There was no improvement in the overall Senior Staff position during the year. One result of this was that the Sokoto Training School for Junior Staff could not be re-opened and must remain closed until an increase in the number of Engineers calls for an increase in field staff.

In Sokoto Province, three more village schemes were completed and remodelling of the old Kwarre scheme was continued. It was encouraging to note that the local farmers were at last beginning to take more interest in the maintenance of the village schemes already completed. In Bornu a start was made on the Lake Chad Pilot Scheme, with the construction or partial construction of some two miles of flood bank and the completion of the foundations for the main drainage sluice.

In the Bida area, an improvement in the Senior Staff position enabled an experienced engineer to be posted to the Pategi area of Ilorin Province to start preliminary investigational work there. On the Edozhigi scheme, completion of the Kaduna River bund was again held up by breakdowns in the heavy machinery, and it was not until a new D4 Caterpillar was purchased that real progress was made. At Badeggi good progress was made towards the completion of the main and subsidiary canals system and at Toroko, a village scheme, enthusiastic co-operation from the farmers in the excavation of the main canal enabled good progress to be made. Plans for the £7,000 Loguma Scheme of about 300 acres were completed and investigations into the proposals for a 2,500 acre scheme at Guzan were begun.

33. *Settlement Schemes*.—Much importance is attached to, and a great deal of money and effort has again been spent on, the various settlement schemes. These range from the major schemes at Kontagora, Shendam, Mokwa and Daudawa, involving some hundreds of settlers, to the several smaller schemes with only a few settlers.

The major schemes at Kontagora and Shendam are under the general management of composite Management Boards made up of relevant Government officials and local representatives and they are largely financed by the Northern Regional Production Development Board. As reports indicate, further progress has been made at both schemes, but whether this progress is altogether sound is still open to doubt. Certainly some settlers are at last beginning to settle down, farm more efficiently and look more prosperous; but this effect is still being achieved only with considerable outside assistance in the form of expatriate management and finance. Until these schemes begin to show signs of standing on their own feet it is difficult to report that real progress is being made.

The *Mokwa Agricultural Scheme* which is, in fact, a mechanised Settlement Scheme is reported in the subsequent section.

Daudawa.—The mixed farming settlers have had a satisfactory year and the co-operative idea is growing.

Badeggi Irrigation Scheme.—The irrigation works being more or less completed the question arose as to what was to be the future of this and other similar schemes. Proposals were completed for declaring the area a Settlement Area, and incorporating the 140 or so existing farmers in a Settlement Scheme, to be run so far as possible by the farmers themselves.

Smaller Schemes.—Reports from the smaller Schemes at Kiru (Kano), Koza and Sagawa (Katsina) and Jema'a (Plateau) were variable and tended to emphasise the difficulty of achieving progress without close supervision and control. The original settlers at Muna (Bornu) have, however, done well and there is some demand from other local farmers to participate in the scheme—a healthy sign.

34. *Mokwa Agricultural Project.*—The Agricultural Department, on behalf of the Northern Regional Government, took over the whole of this Project from the Colonial Development Corporation on 1-6-54. In this scheme, the main object is to bring the advantages of mechanised farming into the peasant system by taking advantage of the co-operative possibilities inherent in an organised settlement scheme.

Immediately on take-over it was decided that the system of ploughing rectangular blocks regardless of the contour would have to be dispensed with because of the severe erosion that was taking place and that as a first step the whole cleared area would have to be conserved with the ploughing strips on graded contours. A start was made on this work by the Engineering Branch, in the Western Ndayako area.

The eighty odd settlers already established on the scheme were retained under provisional cropping arrangements until such time as they can be incorporated in a carefully planned pilot scheme in which mechanised farming under settlement conditions can be fairly and fully tested.

35. *Agricultural Shows.*—There is no limit to the popularity of Agricultural Shows and no less than about fifty were held throughout the Region on a more or less Divisional basis. It is feared, however, that much of the popularity is engendered by the tendency of these shows to become a large scale party at public expense. There is no harm in everybody enjoying themselves during the latter part of the show day but the essential part of a show is Agricultural competition and it is this part that is undoubtedly being seriously neglected and even almost ignored by many Native Authorities. At some places, however, such as Daudawa, Maiduguri, Gummi, Nasarawa and Badeggi where the show has become an annual event and where organisation is more experienced and efficient there is no doubt that these events are beginning to achieve their main purpose, the generation of a spirit of competition amongst farmers with a subsequent improvement in the standard of stock and crops.

The Northern Research Station travelling exhibit attended many of the Shows. Apart from its great value in adding body and spectacle to the Shows, it attracted the interest of the farmers and must have been of great assistance in putting across to them the advice of the Department on many subjects.

36. *School of Agriculture, Samaru*.—Although the Senior Staff was up to establishment throughout the year, it was not adequate for the aim to be achieved of doing all the teaching with Senior Staff.

Lecturers were provided by the Nigerian College of Arts, Science and Technology for certain subjects in the new Assistant Agricultural Officer's course which began in January 1953, and which was made up of twelve students selected from the 1952, 1953 and 1954 Agricultural Assistant courses.

The 1952 and 1953 Agricultural Assistant Classes completed their courses under the accelerated system providing twenty-two Agricultural Assistants for posting and seven recruits for the Assistant Agricultural Officer's course.

The 1954 Agricultural Assistant Class dwindled to twenty-four students.

Recruitment to the 1955 class was disappointing with only twenty-two students reporting of which six were Native Authority trainees. This is largely the result of the policy of the Education authorities, undoubtedly right in the long run, of encouraging Middle IV (or Secondary II) boys to continue at school up to Secondary IV or, eventually Secondary VI standard.

There was no lack of recruits for the Junior Native Authority courses. Of the 1954 class twenty out of twenty-five completed the course and passed the examinations. There were thirty recruits to the 1955 course.

Further figures are given in Appendix II.

37. *Agricultural Training*.—Apart from the work of the School of Agriculture, training of artisans and tractor drivers up to higher standards was undertaken by the Engineering branch. At Kafinsoli Farm School nine boys completed the elementary training course before being sent back to their homes and in Plateau Province six boys were trained in soil conservation work.

38. *Northern Research Station*.—In the last annual report it was noted that a ten year plan for a greatly increased research organisation had been approved in principle. Early in the year under review the plan was approved in detail and the first year's funds were allocated. Building of four new Senior Staff Quarters and chalets part of a Catering Rest House was under way by the end of the year and plans were well advanced for the building of further quarters for both Senior and Junior Staff at Samaru, Shika and Kano.

On the Staff side progress was not altogether satisfactory. Only two more senior staff, a second Cotton Entomologist and a second Pasture Officer, arrived and the Junior Staff position deteriorated with a reduction of

Assistant Agricultural Officers from seven to three and Agricultural Assistants from thirty-six to thirty-one.

A Grassland Mission.—appointed by the Foreign Operations Administration of the United States of America visited Nigeria from June to December in implementation of the Lambert Report recommendations, and made their headquarters at Samaru. The Mission consisted of Mr Walter L. Dutton, expert in Range Management, and Mr Charles Enlow, Pasture expert. The Mission made extensive tours of the whole country but with particular emphasis on the Northern Region. They recommended the expansion, as a matter of urgency, of research on pasture establishment and management. The Forestry and Veterinary Departments as well as the Agricultural Department co-operated closely in giving the Mission information and assistance.

Agronomy Section.—The Section continued its general supervision of all the agronomic experimental work and field trials at both Samaru and outstations and carried out the analysis and summarising of the results.

Amongst the more interesting results it was found that close spacing is advantageous to spreading as well as to the more upright varieties of Groundnuts.

In time of planting trials at Kontagora it was shown that in this particular year it was essential that Groundnuts be planted before mid-May in order to get a good crop and that, because of rosette attack, planting in June was a waste of time.

In Benue, where *Striga senegalensis* is so common in the Guineacorn crops, hand pulling of the parasite produced significant increases in yield.

At Samaru it appeared that, if farmyard manure is to be applied to the rotation of Cotton, Guineacorn, Groundnuts it is more profitable, at present prices and if gross cash yields only are taken into account, to split the manure available amongst the three crops rather than to apply it all to the Guineacorn.

Determined efforts are being made at Samaru to find a method of controlling the grass *Cynodon dactylon* which, after some thirty years continuous cropping, has become a considerable nuisance on the research station there.

Botany Section.—This section was mainly concerned with the collection and selection of local varieties of almost all the main crops grown in the Northern Region and with the importation of new varieties from abroad which held promise of being an improvement on the local varieties.

A good deal of effort continues to be devoted to attempts to obtain better varieties and strains of Groundnuts by selection, hybridisation and new introductions from abroad. This work is still only in its early stages and nothing spectacular has yet emerged, but it is confidently expected that varieties and strains with higher yielding, more disease resistance and other desirable characteristics will in due course be produced.

Work with Dr Webster's crosses between local and American varieties of Guineacorn was continued. Multiplication of introduced varieties of Sugar Cane said to be resistant to Red Rot was continued at Samaru and Maigana.

Plant introductions, numbering forty-three in all, included eight samples of Groundnuts from Argentina, South Africa and Hong Kong and four samples of Sorghum from the United States of America.

Progress was made with the establishment of the *Plant Pathology Section*. The connection of the mains electricity supply to the laboratories enabled equipment already on hand to be brought into use. Some plant diseases were identified at Samaru and specimens were sent to the United Kingdom for confirmation of diagnosis.

Chemistry Section.—The change over from the old D.C. electricity to the main A.C. supply from Zaria enabled some of the new equipment to be brought into use resulting in a marked increase in the number of determinations completed by the laboratory staff.

The Laboratory Staff carried out an increasing volume of routine analysis work mainly concerned with the examination of grasses, fertilisers, feedingstuffs etc, but including such problems as the analysis of citrus juices for the Botanist and the examination of soils for the Engineers, to determine their suitability for use in building dams.

In the standard manurial trials incorporating dressings of farmyard manure, phosphate, Nitrogen and Potash at various levels the apparent detrimental effects of continuous heavy dressings recorded at Kano and Yandev a year ago were not reproduced at those stations this year. Although the results at Samaru this year seemed to point in the same direction with the higher dressing of Superphosphate on guineacorn, these can still be regarded as chance effects until more consistent figures are available. In a general way this important series of trials is indicating a highly significant increase in yields from applications of farmyard manure for all crops at all stations, a similar but smaller response to superphosphate, a response to nitrogen varying according to the test crop and little or no effect from potash.

The sulphur deficiency trials on Groundnuts were continued and the Chemist is now able to conclude that both the sulphur and the phosphate content of Superphosphate contribute to the increases in yield of haulms and kernels by the application of this fertiliser, that the available sulphur in Northern Nigerian soils is marginal as regards the requirements of the Groundnut crop and that in certain areas the lack of available sulphur may become a limiting factor, but that the sulphur requirement of the Groundnut is met by the application of Superphosphate.

In the Riverain Provinces fertiliser investigations were continued both on the Government experimental farms and on private farms and as a result of this, the Chemist has been able to make a provisional recommendation

of a dressing of $\frac{3}{4}$ cwt Sulphate of Ammonia and $\frac{1}{2}$ cwt Superphosphate per acre for maize and up to 1 cwt per acre Sulphate of Ammonia for Yams within thirty miles of Ilorin town.

Trials affecting the Northern Belt included a Placement of Superphosphate experiment which showed clearly that the recommended practice of placement 1 inch away from the seed is the best for food crops but that in the case of cotton the fertiliser can be safely applied in contact with the seed.

A series of trials designed to find out the reasons for the poor growth of crops on Yola Experimental Farm indicated a severe nutrient deficiency, probably with phosphate as the major factor.

The field work of three detailed soil surveys was completed on the Government Farm at Zonkwa (500 acres), Osara (500 acres) and the Northern Research Station, Samaru, (2,000 acres). Interim reports with coloured soil maps were prepared for Zonkwa, Osara and Lowland Experimental Station surveyed in 1953-54. The report on the Northern Research Station survey will be completed in the coming year.

Samples of irrigation water from the Rima fadama in Sokoto have been analysed, with particular attention being given to the salts which they carry and tend to deposit. Gas samples were taken from the Argentine Grain Storage tank at Samaru which showed the CO_2 content gradually rising to some 12 per cent at which level it remained constant until the tank was opened.

Cotton Section: (a) Breeding and Selection.—A programme of hybridisation was commenced, designed to combine the good characters of local strains with desirable features of a number of introduced types. This is long term work but will become of increasing importance as the present programme of straight reselection from Allen stocks approaches the point where further advances are limited by decreasing genetic variability.

In the District variety test, reselections from Samaru 26C have shown themselves to be superior to the original stock. In particular the line 479-25 has been confirmed as superior to 26C in yield both of seed cotton and lint and can now be accepted as the successor to 26C.

A multiplication plot of 5.8 acres of 479-25 B.C.P. produced, with manuring, 1,150 lbs seed cotton per acre at Samaru—an outstanding yield for Nigeria. As a result of devoting so large an area to this one strain, and because of the high yield there should be enough seed to supply Stage C of the Daudawa Multiplication Scheme, thus by-passing Stage B, and saving a year. If the increase in yield comes up to the expected 8 per cent the financial gain from thus saving a year, will be about £800,000 at present levels of prices and production.

(b) Entomology.—Observations on the most important pests of cotton taken at various stations throughout the season showed that populations were on the whole less than reported in the previous year. The more Southerly

Cotton growing areas again suffered the heaviest losses, both in quality and in quantity of cotton produced.

At Samaru and Daudawa little benefit was gained from the use of insecticides but at Kontagora, where insect damage is severe, large increases in yield followed the application of a series of spray treatments. Although these increases are uneconomic, it is thought that further trials in this areas may yield valuable information.

Grassland Section.—Plans were completed for the transfer of this section from Samaru to Shika Stock Farm where there is much more land available for pasture experiments.

Comparison of cutting treatments on four species showed that the massive grasses, *Sorghum* and *Rottboellia*, gave less total yield but much more crude protein when cut twice at seven and seventeen weeks after planting, than with one cut at eleven weeks and the taking of an after-math at twenty-one weeks. The finer grasses, *Chloris* and *Pennisetum*, gave if anything less total crude protein with two cuts.

Investigation of the performance of pastures under different treatments including mowing, grazing, burning and manuring were continued; but this work is still in its early stages and conclusive results cannot be expected yet. It has been shown, however, that burning at the beginning of the dry season, so often recommended for other reasons, favours scrub growth whereas burning at the beginning of the rains, probably impracticable in normal circumstances, favours grass establishment and checks the scrub. It also seems that one mowing with subsequent grazing each rains results in the best cover and an attractive pasture.

APPENDIX I.—SUMMARY OF HERD RECORDS FOR YEAR 1954-55

BREEDS: White Fulani and Sokoto
STATION: Shika, Zaria (Nigeria)

AVERAGE RAINFALL:
MEAN ANNUAL TEMPERATURE:

1	2	3	4	5	6	7	8	9	10	11	12
Total number of Adult Females in Herd at 31-3-55	Average out-put milk per cow per annum	Number of full time Lactations	Lactation Record in lbs.				Average Butter- fat yield	Calving intervals Days	Average Daily Yield		
			Average yield in 305 days	Range in Yield and days	Average Lactation Period in Days	Average Butter- fat per cent			During Lactation	Between Calves	Remarks
White Fulani Heifers (in Milk) ... 16 W.F. Cows ... 114	4	4	2385.5	Minimum 139 in 43	209.9 (14)	Butter-fat testing not carried out Figures of 6½ per cent accepted for these Breeds.	437.4	5.78	3.61		
		34	2950.0	Maximum 4527 in 305	272.0 (51)						
Total ... 130	1424.7	38	2891.0		258.6 (65)			8.66	3.31		
Sokoto Heifers (in Milk) ... 10		0	—	Minimum 671 in 145	159.7 (3)			5.83	1.54		
		17	2902.4	Maximum 4351 in 305	281.0 (26)		438.5	9.13	6.44		
Total ... 34	1999.5	17	2902.4		268.5 (29)			8.79	5.93		

Notes:

1. Daily recording.
2. Calves weaned at four days.
3. Handmilk cows 3 x for first three weeks. Machine 2 x.
4. Average ages of Heifers at calving are as follows:—White Fulani (14) 4.16 years. Sokoto (3) 4.22 years.
5. Feeding:—Wet season: Bush grazing plus concentrates. Dry Season: Bush grazing, Mucuna hay, silage, guineacorn leaves plus concentrates.
6. Lactation figures based on lactations of cows and heifers which subsequently calved between 1/4/54-31/3/55.
7. Three extraordinary lactations under 33 lbs. (two W.F. Heifers) ignored in columns 3-11.
8. Figures in brackets show number of lactations for calculations in columns 6, 9, 10, 11.
9. Full-time lactations irrespective of subsequent calving shown in remarks column. They were completed between April 1st of first year and 31st March of second year
10. Figures in column 2 low owing to large number of dry cows. (At 31-3-55 there were 90 out of 760).

APPENDIX II.—RECORD OF STUDENTS AT SAMARU SCHOOL OF AGRICULTURE FROM 1932 TO 1955

Year beginning 1st of April		1932	1933	1934	1935	1936	1937	1938	1939	1940	1941	1942	1943	1944	1945	1946	1947	1948	1949	1950	1951	1952	1953	1954	1955
Number of Students recruited each year.	(i) Agric. Assts. Course	3	5	—	6	—	8	4	11	7	11	17	12	15	13	20	13	31	26	30	54	29	27	58	23
	(ii) N.A. Junior Course	3	5	—	6	—	8	4	11	7	11	17	12	15	13	20	13	31	29	23	28	30	38	30	
	(iii) Total	6	10	—	12	—	16	8	22	18	22	34	24	30	26	40	26	62	55	53	82	57	88	53	
Total Students in training at beginning of Academic Year.	(i) Agric. Assts. Course	3	8	8	6	6	8	12	15	18	18	28	25	33	31	40	41	58	56	64	97	97	97	92	—
	(ii) N.A. Junior Course	3	8	8	6	6	8	12	15	18	18	28	25	33	31	40	41	58	29	23	28	29	28	25	
	(iii) Total	6	16	16	12	12	16	24	30	36	36	56	50	66	62	80	82	116	85	87	125	126	120	117	
Number successfully completed Course.	(i) Agric. Assts. Course	—	3	5	—	6	—	6	4	10	7	7	—	7	5	6	7	13	10	15	15	17	56	26	
	(ii) N.A. Junior Course	—	3	5	—	6	—	6	4	10	7	7	—	7	5	6	7	13	10	20	15	21	20	21	
	(iii) Total	—	6	10	—	12	—	12	8	20	14	14	—	14	10	12	14	26	20	35	30	38	76	47	
Failures in Examinations.	(i) Agric. Assts. Course	—	—	—	—	—	—	1	—	1	—	2	—	1	1	1	1	—	4	4	4	5	10	2	
	(ii) N.A. Junior Course	—	—	—	—	—	—	1	—	1	—	2	—	1	1	1	1	—	—	9	8	8	5	1	
	(iii) Total	—	—	—	—	—	—	2	—	2	—	4	—	2	2	2	2	—	4	13	12	13	15	3	
Resignations and Dismissals etc.	(i) Agric. Assts. Course	—	—	—	—	—	—	—	—	—	—	6	7	7	5	5	6	15	8	2	10	10	12	31	
	(ii) N.A. Junior Course	—	—	—	—	—	—	—	—	—	—	6	7	7	5	—	—	—	—	—	—	—	—	—	
	(iii) Total	—	—	—	—	—	—	—	—	—	—	12	14	14	10	5	6	15	8	2	10	10	15	34	

NORTHERN RESEARCH STATION, SAMARU ANNUAL REPORT, 1954-55

PART I.—GENERAL INTRODUCTION

By J. H. Gisborne

In the last annual report of the Northern Research Station it was noted that a ten year plan for a greatly increased research organisation had been approved in principle. Early in the year under review the plan was approved in detail, and the first year's funds were allocated. Building of quarters for four extra senior staff and of two chalets towards a Catering Rest House, was well under way by the end of the year, and plans were well advanced for the building of further quarters for both senior and junior staff at Samaru, Kano and Shika.

Preliminary work has also been done towards the building of a large new administrative and laboratory block at Samaru, and an office and laboratory block for the Pasture and Animal Husbandry section at Shika, but the start of building is not yet in sight.

Indents were placed for almost all the additional senior staff posts envisaged in the ten year plan, but it is not expected that all of these will be quickly filled.

Two members were added to the senior staff during the year, a second Cotton Entomologist (seconded from the E.C.G.C.), and a second member of the Grassland team, who is to work mainly on the agronomy aspect of pasture. There are prospects of the early further addition of a grassland officer ex-Sudan, and of two plant breeders and a plant pathologist at present doing their Trinidad training.

As far as the junior staff is concerned the position has not improved. At the close of the period there were three Assistant Agricultural Officers and thirty-one Senior Agricultural Assistants and Agricultural Assistants as compared with seven and thirty-six respectively at the corresponding period last year.

Lists of established staff in all sections appear in Appendix I of this year.

VISITORS

The station was honoured by a visit from Sir John Macpherson G.C.M.G., Governor of Nigeria (later Governor-General of the Federation) on the 24th April.

Among the many other visitors during the year were:

Mr K. O. Mbadiwe, Central Minister of Lands and Natural Resources.

Mr R. A. Njoku, Central Minister of Commerce and Industries.

Sir Hilton Poynton, K.C.M.G., Deputy Under Secretary of State for the Colonies.

Mr E. K. Featherstone, Commissioner for Nigeria in the United Kingdom.

Mr J. Holt, Liverpool,

Dr A. Muir, Rothamstead.

Dr D. W. Russell, Oxford University.

Mr R. V. Harris, Natural History Museum, London.

Mr G. Alan Stewart, Commonwealth Scientific and Research Organisation.

Mr G. G. Murray

Mr T. E. Darter

Mr J. H. Stapley

Mr A. T. Baillie

} Plant Protection Limited, Fernhurst.

MISSIONS

A Grassland Mission appointed by the Foreign Operations Administration of the United States of America visited Nigeria from June to December in implementation of the Lambert Report recommendations, and made their headquarters at Samaru. The Mission consisted of Mr Walter. L. Dutton, expert in Range Management and Mr Charles Enlow, Pasture expert. The Mission made extensive tours of the whole country, but with particular emphasis on the Northern Region, and submitted a report on the present livestock and pasture position, together with recommendations for the expansion, as a matter of urgency, of research on pasture establishment and management and range management. The Forestry and Veterinary departments as well as the Agricultural departments co-operated closely in giving the Mission information and assistance.

METEOROLOGICAL DATA

Table 1 shows the meteorological data recorded at Samaru in 1954:

TABLE 1

<i>Month</i>	<i>Rainfall</i> 1954 <i>ins. (days)</i>	<i>Average</i> 1924-54 <i>ins.</i>	1954 <i>Mean</i> <i>RH %</i>	1954 <i>Mean</i> <i>Max °F.</i>	1954 <i>Mean</i> <i>Min. °F</i>	1954 <i>Mean</i> <i>Temp. °F</i>
January ...	—	—	16.7	87.7	56.5	72.1
February ...	0.48	0.06	22.2	93.9	63.8	78.9
March ...	3.11	0.39	31.5	95.4	69.4	82.4
April... ...	2.55	1.24	53.5	95.2	70.3	81.8
May	8.65	5.43	67.6	88.2	68.3	78.3
June... ...	6.16	6.36	71.8	86.5	67.1	76.8
July	6.61	8.78	74.4	81.3	66.1	73.7
August ...	16.42	11.87	79.6	80.6	66.2	73.4
September ...	12.32	8.67	69.0	85.2	65.9	74.6
October ...	1.28	1.35	57.7	87.1	65.2	76.2
November ...	0.76	0.05	30.1	89.2	61.1	75.2
December ...	—	0.01	21.4	86.9	56.6	71.8
Total ...	58.34	44.20	49.6	87.8	64.7	76.3

The year was remarkable for the length of the wet season and the amount of rain which was the highest total ever recorded. In parts of the farm where soil conservation measures have been put into effect so much water was held up that severe waterlogging resulted.

Notes.—Throughout the report, significant differences are indicated by N.S. Not significant

* Significant at P equals 0.05

** Significant at P equals 0.01

*** Significant at P equals 0.001.

Local names are used for common crops throughout the report, but an explanatory list of these is included as Appendix II.

PART II.—AGRONOMY SECTION

By E. J. Butler

A.—GENERAL

CROPS

There was abnormally heavy rain in February and March. In consequence when the normal planting rains arrived a very heavy growth of *Cynodon dactylon* necessitated extensive preliminary weeding. Labour was short at this period and it was difficult to get crops planted in good time. One cotton experiment which included an early planting treatment had to be cancelled. The planting rains were good and although 28.74 inches of rain in August and September caused waterlogging the season was on the whole satisfactory. There was a moderate amount of rosette in groundnuts due possibly to the freak early rains. Yields of all crops were reasonable.

TABLE 2.—AVERAGE YIELDS IN LBS PER ACRE OF MAIN CROPS
1952-54

Season			Seed Cotton Samaru 26C	Guineacorn Grain		G'nuts Kernels
				Light Mori	Short Kaura	
1952	...	...	301	1,013	1,173	729
1953	...	...	430	603	1,144	754
1954	...	...	473	861	944	606

CATTLE

The policy of crossing grading Ndama and white Fulani Zebu cross-breeds both towards the pure Ndama and the pure Zebu type continued. Data to date show that the first cross is a very satisfactory animal. It is as heavy as the Zebu, retains much of the solid meaty frame of the Ndama and is an excellent worker. The milk yield of the cows is as good as that of the

Zebu dams. But with further increases in the proportion of Ndama blood a good deal of the size necessary for work is lost. The health of the cattle has been generally good apart from occasional cases of trypanosomiasis. The birth of twenty-eight calves of which four were lost has begun to repair the damage done by rinderpest last year. The balance of stock of various classes at 31st March 1955 is as shown in Table 3.

TABLE 3.—NO. OF CATTLE IN ZEBU-NDAMA HERD AT 31-3-55

Class			NZXN	NZXXZ	NZ	Z	N	Total
Stock bulls	...	...	—	—	—	1	1	2
Cows	...	...	—	—	15	14	—	29
1-3 yr. Bulls	...	...	1	1	4	1	—	7
1-3 yr. Heifers	...	...	—	1	1	—	—	2
Bull calves	...	...	6	3	8	2	—	19
Heifer calves	...	...	4	6	5	—	—	15
Total	...	...	11	11	33	18	1	74
Total 31-3-54	...	...	4	6	25	19	1	55

N equals N'dama; Z equals Zebu; NZ equals halfbred.

B.—EXPERIMENTS REPORT

GROUNDNUTS

(1) *Deterioration of Groundnut seed, Daura.*—There have been indications that varieties of groundnuts introduced to Daura fall off in performance after a few years there. Seed of variety Castle Cary is being introduced each year and tested against seed from former introductions. The standard Local Spreading variety is included for comparison.

TABLE 4.—DETERIORATION OF GROUNDNUT SEED

Yields in lbs. kernels and dry hay per acre

		Kernels	Haulms	Germination Test per cent	Stand count at harvest per cent
		***	***		
Local spreading	...	637	414	86	72.1
New Castle Cary	...	561	570	—	78.1
Old Castle Cary	...	323	312	50	30.8
Once grown Castle Cary	...	151	224	54	24.0
S.E.	...	±33	±25		
Sig. diff. 5 per cent	...	99	75	—	—
Sig. diff. 1 per cent	...	136	104	—	—
Sig. diff. 0.1 per cent	...	189	144	—	—

The experiment is in its early stages and fuller comparisons will be available in the future. This year's trial (Table 4) shows that deterioration does take place and that reduction in yield is due partly to poor germination and partly to the poorer survival ability of plants from Castle Cary seed grown at Daura. If the superiority of old seed over once grown seed is repeated a certain amount of natural selection may be assumed.

(2) *Spacing of Spreading groundnuts, Kafinsoli*.—In the case of upright groundnuts it had been shown that closer spacing than that used by the local farmer gave greater yields per acre. It was decided to test at Kafinsoli whether this also applied to spreading groundnuts. Castle Cary, an upright variety, was included for comparison. The spacings were 6", 9" and 18" on 3' ridges.

TABLE 5.—SPACING OF SPREADING GROUNDNUTS

Yields in lbs. kernels and dry hay per acre

					Kernels **	Seed Rate	Haulms *
Castle Cary	6"x3'	...	...	...	871	48	729
Local Spreading	6"x3'	...	...	...	844	45	754
Local Spreading	9"x3'	...	...	...	780	31	703
Local Spreading	18"x3'	...	...	...	611	16	594
S.E.	...	...	...	...	±46	—	±53
Sig. Diff. 5 per cent	...	...	...	...	136	—	99
Sig. Diff. 1 per cent	...	...	...	...	186	—	—

It is clear (Table 5) that closer spacing is also advantageous with spreading varieties of groundnuts.

(3) *Dates of planting groundnuts, Kontagora*.—The choice of the optimum time for planting groundnuts at Kontagora is complicated by a customary heavy attack of rosette on the later plantings. Instead of a formal randomised trial which is ill-suited to investigate optimum dates of planting it was decided to use plots of ten square yards planted after every suitable rainfall during May and June. Two varieties were used, Castle Cary and a local variety Kotonkoro.

TABLE 6.—DATES OF PLANTING GROUNDNUTS.

Yields in lbs. kernels per acre

	Date			S. 38	Kotonkoro
May	5	...	...	719	722
	11	...	...	692	630
	14	...	...	628	534
	16	...	...	429	286
	21	...	...	258	329
	26	...	...	222	207
June	2	...	...	65	—
	9	...	...	33	6
	13	...	...	5	15

It is clear (Table 6) that in this particular season groundnuts needed to be planted in the first half of May. Plantings later than June 13th gave no yield at all.

(4). *Behaviour of groundnut Variety K 50 in different localities.*—Trials were carried out for the fifth year at different localities in Kano Province to test the suggestion that the variety K 50 might lose its superiority over local spreading in the north of the province and whether in this zone ridged cultivation is better than flat. Unfortunately of the four trials those at Malammaduri and Birnin Kudu were failures.

TABLE 7.—VARIETY AND CULTIVATION TRIAL

				<i>Yields in lbs. kernels per acre</i>	
				<i>Kano</i>	<i>Kazaure</i>
				***	*
<i>Varieties:</i>					
K 50	...	...	...	860	615
Local	...	...	...	496	512
<i>Cultivations:</i>				N.S.	N.S.
Ridge	...	...	...	642	552
Flat	...	...	...	714	575
S.E.	...	...	...	±32	±26

VARIETY X CULTIVATION. COMBINED YIELDS 1954

				<i>K 50</i>	<i>Local</i>	<i>Mean</i>
Ridge	...	...	...	671	484	578
Flat	...	...	...	765	565	665
Mean	...	...	...	718	525	

The year was a favourable one for K 50 (Table 7). But examination of the results over the five years leads to the conclusion that although it is superior to Local Spreading in the zone in which it was bred this superiority disappears in the drier zone.

Flat cultivation yielded better than ridged but not significantly so. In nine of the twenty-six successful trials carried out since 1950 ridged cultivation was significantly better than flat. In no trial was the reverse the case. There was no interaction between varieties and cultivation both varieties tending to do better on the ridge. This was so both in the drier and wetter zones.

GUINEACORN

(1). *Effect of Striga on yield of guineacorn.*—Investigations into the effect of the parasite, *Striga senegalensis*, on the yield of guineacorn at several levels of fertility continued at Samaru and Yandev. At Yandev abundant natural infection is assured but at Samaru artificial infection by annual planting of striga seed is necessary and for the first time a mild attack of the parasite was obtained. Yields are shown in Table 8.

TABLE 8.—EFFECT OF STRIGA ON GUINEACORN
Lbs. grain per acre and Striga counts per acre

	Yandev		Samaru	
	Grain ***	Striga Counts	Grain ***	Striga Counts
<i>Farmyard Manure:</i>				
10 tons per acre ...	800	75,965	—	—
3 tons per acre ...	459	77,549	1,072	8,833
Nil tons per acre ...	169	53,268	321	4,208
S.E. ...	±53	—	±55	—
<i>Hand pulling of Striga:</i>			N.S.	
Pulled ...	751	111,570	723	3,188
Not pulled... ..	452	26,297	670	9,853
S.E. ...	±38	—	±55	—
<i>Infection:</i>			*	
Infected ...	—	—	591	9,466
Not infected ...	—	—	802	3,574
S.E. ...	—	—	±55	—

INTERACTION, YANDEV

	<i>Pulled</i>	<i>Not pulled</i>
10 tons	971	629
3 tons	616	303
Nil	196	142
S.E.±52		

No interaction at Samaru was significant.

F.Y.M.—There was the usual response to manure at both stations.

Hand pulling.—At Yandev there was a significant increase in yield for the third successive year due to hand pulling Striga. At Samaru there was also an increase but this is not significant possibly due to the much lower degree of infection. (Note: In previous reports the term “eradication” of Striga has been used. In fact the Striga is hand pulled, and there are grounds for suspecting that in many cases the underground parts of many plants remain *in situ*, and regrowth takes place. In these circumstances, eradication is a misnomer, and the term “hand pulling” has been adopted).

Infection.—Infection reduced yield significantly for the first time. This was also the first year in which there was much difference in the amount of Striga in the infected and uninfected plots.

Interaction.—The interaction between manure and hand pulling was significant at Yandev for the second year running. This is due to the greater ability of manure to increase yield in the hand pulled plots and supports the conclusion that hand pulling increases yield.

(2). *Chemical Control of Striga in Guinea-corn.*—An observation on the effect of Agroxone 4 in controlling Striga was conducted at Bida. The

rate of application however was too low and although the chemical delayed the appearance of *Striga* it had no other effect on the parasite or on yield. Virtually no yield was obtained.

BENNISEED

(1). *Dates of planting, Kontagora.*—A date of planting observation on Benniseed was carried out at Kontagora in the same way as that on ground-nuts,—ten square yards planted over a period after each suitable rain. Planting was supposed to begin on May 1st but, due to unknown causes, began instead on the last day of July.

TABLE 9.—DATES OF PLANTING BENNISEED
Yields in lbs. seed per acre

July				August							
Date	31	2	4	6	8	10	12	14	16	18	20
Yield	170	285	206	218	249	316	31	16	23	294	35
				August				September			
Date	22	24	26	28	30	1	3	5	7	9	11
Yield	241	162	170	194	103	121	96	184	6	49	54

Planting was done every second day since at this time of the year soil moisture is always ample. It appears that moderate yields may be obtained by planting in the first three weeks of August (Table 9). Planting continued to 29th of September but these later plantings, not shown in the table, averaged only 26 lbs. per acre. It appears that low yields result from planting after heavy rain. After 5.55 inches of rain on the 11th of August and 1.76 inches on the 12th the three subsequent plantings yielded only 31, 16 and 23 lbs. Similarly the planting after 0.82 inches on the 19th yielded only 35 lbs.

SOYA BEANS

(1) *Dates of planting, Kontagora.*—A date of planting Soya Beans trial on the same lines as the above was carried on at Kontagora. Planting was carried out after suitable rains from 5th May to 21st July. Yields were as shown in Table 10.

TABLE 10.—DATES OF PLANTING SOYA BEANS
Yields in lbs. seed per acre

May					June					
Date	5	11	14	16	21	26	2	9	13	21
Yield	129	53	50	499	26	996	545	1199	1260	580
					June			July		
Date	24	26	28	30	2	4	6	8	10	12
Yield	1049	1220	1014	1366	1150	1111	80	379	354	139
					July					
Date	14	16	19	21						
Yield	663	374	386	192						

It is clear that the month of June is the optimum time to plant. The anomalous low yields of 21st May, 2nd June and 21st June were the result of planting when the soil was too dry. The crop received 1 cwt. of super-phosphate per acre.

COWPEAS

Variety Trial, Yandev.—Two varieties of cowpeas, New Era and Mauritius, had been found to yield much more heavily than the Yandev local variety when grown as a sole crop. The varieties were tested again in 1954 interplanted through yams as this is the way they are normally grown in that area. Two spacings were tried—one stand and two stands between yams spaced 3 feet apart on 6 foot ridges. Yields are shown in Table II.

TABLE 11.—COWPEA VARIETY TRIAL
Yields in lbs. threshed seed per acre

Varieties	...	...	...	N.S.	Spacing	...	...	...	N.S.
Mauritius	...	...	...	293	Wide Spacing	...	...	...	259
Local	...	...	...	247	Close Spacing	...	...	...	257
New Era	...	...	...	233	S.E.	...	...	...	±15
S.E.	...	...	...	±18					

Interaction*

				<i>Close</i>	<i>Wide</i>
Local	...	...	...	211	282
New Era	...	...	...	226	239
Mauritius	...	...	...	333	254
S.E.	...	...	...	±25	
Sig. Diff. 5%	...	...	...	74	

The marked superiority of the introduced varieties when grown alone was not repeated when interplanted. The interaction of varieties and spacing was significant at 5 per cent. The local variety did better at the wider spacing and of the other two, both of which are of a more upright habit, New Era was indifferent to spacing and Mauritius did better at the closer spacing. This last treatment was significantly better than all others except Local at the wider spacing.

ROTATIONS

(1) *Effects of Monocropping.*—The comparison of crops grown continuously on the same land and grown in a rotation, at different levels of fertility, was continued at Samaru and Bida for the fifth year. At Samaru the rotation is cotton, guineacorn, groundnuts and at Bida it is cotton, groundnuts, cassava. The fertility levels are obtained by applying 0, 1, 3 and 5 tons f.y.m. annually. Yields are presented in Table 12. (Guineacorn lbs. grain, groundnuts lbs. kernels, cotton lbs. seed cotton, cassava lbs. fresh tubers per acre).

TABLE 12.—MONOCROPPING *V* ROTATION
Guineacorn

<i>Manuring</i>	<i>Samaru</i>		<i>Bida</i>	
	<i>Monocrop</i>	<i>Rotation</i>	<i>Monocrop</i>	<i>Rotation</i>
Nil	300	366	67	353
1 ton f.y.m. ...	871	1,022	201	512
3 ton f.y.m. ...	1,550	1,524	491	845
5 ton f.y.m. ...	1,411	1,759	744	1,061
Mean	1,033	1,167	376	693

Groundnuts

<i>Manuring</i>	<i>Samaru</i>		<i>Bida</i>	
	<i>Monocrop</i>	<i>Rotation</i>	<i>Monocrop</i>	<i>Rotation</i>
Nil	415	439	54	41
1 ton f.y.m. ...	683	909	52	83
3 ton f.y.m. ...	910	651	33	71
5 ton f.y.m. ...	1,164	1,325	44	116
Mean	792	831	46	78

Cotton

Cassava

<i>Manuring</i>	<i>Samaru</i>		<i>Bida</i>	
	<i>Monocrop</i>	<i>Rotation</i>	<i>Monocrop</i>	<i>Rotation</i>
Nil	261	267	781	1,117
1 ton f.y.m. ...	401	597	3,310	4,780
3 ton f.y.m. ...	620	809	5,729	7,258
5 ton f.y.m. ...	833	980	8,383	9,005
Mean	529	645	4,551	5,540

The yields will not be statistically analysed until the end of the second cropping cycle (1955).

Guineacorn.—Monocropping again reduced yields at both Stations but the effect was less marked at Samaru than in previous years.

Groundnuts.—There was the usual small reduction in yields due to monocropping at Samaru. At Bida the crop failed. There was a heavy attack of rosette and most of the shells were empty at harvest time.

Cotton.—Monocropping also reduced the yield of cotton. The interaction between manuring and cropping noticed in the previous two years was virtually absent.

Cassava.—As in previous years monocropping reduced the yield of cassava.

(2) *Extension of Cropping in a Rotation with Fertiliser, Yandev.*—At Yandev the standard rotation is a 3 year fallow of *Andropogon gayanus* followed by yams, grain, benniseed (grain consists of guineacorn interplanted with bulrush millet). As land is short in the area it was desired to see if the cropping cycle could be extended to 4 years by applying fertilisers to a second crop of yams or the first crop of corn. The fertiliser consisted of 150 lbs. of sulphate of ammonia and 150 lbs. of superphosphate per acre. Yields over the four years are given in Table 13.

TABLE 13.—EXTENSION OF CROPPING

1951		Yams, straight crop. Average yield 4958 lbs./ac.			
1952		Yams + fertiliser 8,395	Yams 6,766	Grain + fertiliser 1,332	Grain 666
1953	Grain	672	338	343	180
1954	Benniseed	351	286	317	227
1954. Benniseed					
	S.E.	= ±14			
	Sig. Diff. 5%	= 42			
	Sig. Diff. 1%	= 57			
	Sig. Diff. 1%	= 77			

It had already appeared that the cycle could be successfully extended by taking a second crop of yams with fertiliser and this is confirmed by the significant residual effect of the fertiliser on Benniseed.

(3) *Other rotation trials* have been initiated at Yandev and Bida but it will be some years before they give useful information.

FALLOWS

(1) *Types of Fallow with Planted Woody Shrubs, Yandev.*—The rotation here is 3½ years fallow followed by yams, grain, benniseed. The planted woody shrubs are *Lophira alata* and *Afzelia africana*. This is the first year of the third cropping cycle with yams as the test crop. (Table 14).

TABLE 14.—TYPES OF FALLOW
Yields of yams in lbs. tubers per acre

Fallow					Yield
Pigeon pea	...	...	...	...	10,294
Andropogon gayanus	...	...	...	...	9,627
Natural regeneration	...	...	...	...	9,534
Natural regeneration with planted shrubs	...	...	...	...	9,050

It proved difficult to establish the woody shrubs and this was the first crop after a satisfactory cover had been obtained. But, as in the past, there were no significant differences in yields.

(2) A trial at Maigana of methods of treating different fallow crops was a failure. The site tends to waterlog with average rainfall and the test crop, guineacorn, was drowned by the abnormally heavy rains of 1954. The average yield was only 171 lbs. of grain per acre.

(3) Seven other fallow trials which are not in the cropping cycle or have not yet reached the stage of statistical analysis are being conducted at Daura, Bida, Samaru, Maiduguri, Yandev and Yola.

MANURES

(1) *Permanent Manurial Demonstration, Kano.*—Millet and groundnuts have been cropped on the same land since 1931 and manured annually with 3 tons f.y.m. V nil. (see table 15).

TABLE 15.—PERMANENT MANURIAL DEMONSTRATION

Yields in lbs threshed seed per acre				<i>Millet</i>	<i>Groundnuts</i>
				<i>Sig.</i>	<i>Sig.</i>
3 tons f.y.m. annually	...	...	...	786	915
Nil f.y.m. annually	...	...	...	252	461
S.E. $\pm$	...	...	...	30	41

Groundnuts continued to maintain a surprisingly high yield after 24 years of monocropping without manure. The yield of unmanured millet is still slowly decreasing.

(2) *Restoration and Maintenance of Fertility, Kano.*—The same trial as in the previous paragraph but with guineacorn as the test crop was discontinued after 1949 as the yield of corn on the unmanured plots had fallen to almost nil. The trial was converted into two Latin squares. In one (Table 16) various fertiliser treatments were applied to the previously unmanured land to study how fertility could best be restored. In the other (Table 17) various rates of f.y.m. were applied to the previously manured land to see how they maintained fertility. Cropping with guineacorn continued.

TABLE 16.—RESTORATION OF FERTILITY

Guineacorn, lbs grain per acre

				1954	1953	1952	1951	1950
<i>Annual Dressing</i>					***	***	***	***
3 tons f.y.m. per acre	...			482	372	491	616	247
75 lbs. N, 150 lbs. P per acre				6	175	205	450	33
75 lbs. N per acre	...			3	106	155	266	7
150 lbs. P per acre	...			5	91	207	389	36
50 lbs. K per acre	...			3	81	173	321	8
Nil	...	...	...	8	66	133	272	4
S.E. $\pm$	...	...	...	—	31	14	34	14

In Table 16 the 1954 yields were not analysed. It is clear that while an annual application of 3 tons f.y.m. is slowly restoring fertility the other treatments are failing to do so after a promising start in 1951. The fact that yields were reduced by a June drought is irrelevant. Restoration of fertility is more difficult than was expected. Leaf samples were collected by the Chemist in 1953 from the different treatments but spectrographic analysis did not reveal any differences in the contents of minor elements.

TABLE 17.—MAINTENANCE OF FERTILITY

Lbs grain per acre

	1954	1953	1952	1951	1950
<i>Treatments</i>	***	***	**		*
3 tons f.y.m. annually ...	783	893	1,053	974	816
2 tons f.y.m. annually ...	543	818	863	986	665
1 ton f.y.m. annually ...	398	670	799	918	608
3 tons f.y.m. every 3rd year	364	776	979	1,032	828
2 tons f.y.m. every 3rd year	261	626	876	829	693
Nil	76	330	584	813	539
S.E. $\pm$	54	67	52	77	66
5% Sig. Diff.	160	193	153	—	196
1% Sig. Diff.	219	258	208	—	—
0.1% Sig. Diff.	296	341	—	—	—

(Note.—In the cases of f.y.m. applied every 3rd year the dressings were applied in 1950 and 1953).

In Table 17 three tons f.y.m. applied annually appears to maintain the fertility of monocropped guineacorn. Other treatments are losing fertility at a rate inversely proportional to the amount of manure they receive. The nil treatment has lost its accumulated fertility.

(3) *Optimum use of f.y.m. in a Rotation, Samaru.*—An experiment was carried out at Samaru for six years to determine the method of applying f.y.m. which would give the best economic return in a rotation of Cotton followed by Guineacorn followed by Groundnuts. In the final analysis the figures for the last three years only were taken, as during the first three years the plots were settling down to the different methods of application and to the rotation.

The methods were as follows.—

- (a) All the f.y.m. to Guineacorn (standard practice)
- (b) Half to Guineacorn and half to Cotton.
- (c) One-third to each of the three crops.

There were two rates of manuring; these were a total of 3 tons and of 6 tons respectively during each three years of the rotation.

As might be expected the application of 6 tons f.y.m. was significantly better than 3 tons for all crops. Similarly for each crop the method of application which applied the most manure to that crop was best. Table 18 shows the increased or decreased yields of the different crops resulting from the different methods of application taking the treatment "All to Guineacorn" as the standard. (Yields, which are the average for three years, are in lbs. threshed grain, shelled nuts and seed cotton per acre. C = Cotton: G = Guineacorn: P = Groundnut).

TABLE 18.—OPTIMUM USE OF F.Y.M.

	3 tons f.y.m.			6 tons f.y.m.		
	C	G	P	C	G	P
All to G	325	1,232	778	444	1,565	949
$\frac{1}{2}$ G $\frac{1}{2}$ C	+159	—124	—31	+175	—239	—2
$\frac{1}{3}$ G $\frac{1}{3}$ C $\frac{1}{3}$ P ..	+105	—279	+256	+81	—398	+282

It is inevitable in such an experiment that the answer is entirely dependent on the relative prices of the three crops. Taking cotton as 5.8*d* a lb., guineacorn at £25 a ton and groundnuts at £34 a ton the average cash returns over the three years of the different methods of application are shown in Table 19.

TABLE 19.—CASH RETURNS FROM F.Y.M.
3 tons f.y.m.

	C	G	P	Total	Increase
All to G.	£7 17 1	£13 15 0	£11 16 2	£33 8 3	£— — —
$\frac{1}{2}$ G $\frac{1}{2}$ C	11 13 11	12 7 4	11 6 9	35 8 0	1 19 9
$\frac{1}{3}$ G $\frac{1}{3}$ C $\frac{1}{3}$ P	10 7 10	10 12 9	15 13 11	36 14 6	3 6 2

6 tons f.y.m.

	C	G	P	Total	Increase
All to G	£10 14 7	£17 9 4	£14 8 1	£42 12 0	£— — —
$\frac{1}{2}$ G $\frac{1}{2}$ C	14 19 2	14 16 0	14 7 6	44 2 8	1 10 8
$\frac{1}{3}$ G $\frac{1}{3}$ C P	12 13 9	13 0 6	18 13 8	44 7 11	1 15 11

It is clear that at present produce prices the decreased yield of Guineacorn caused by dividing the manure between the crops is more than compensated by the increased yield of the more expensive cash crops. The effect is more marked at the lower rate of manuring which is the one normally used. Using this rate the standard method of applying all the f.y.m. to Guineacorn

would be as good as dividing it between the three crops only if the price of Guineacorn rose to £31 a ton.

(4) *Rates of f.y.m. in Continuous Cropping Yandev.*—An experiment was conducted at Yandev from 1950 to 1951 to find the optimum rate of application of f.y.m. to a rotation of grain, benniseed, yams. The manurial rates were 1, 2 and 3 tons f.y.m. applied to the grain crop only. It was found that 1 ton was declining in fertility, 2 tons was holding its own and 3 tons was gradually improving. It was then decided that further information could be obtained on maintenance of fertility by changing the treatments as follows.—

Control Increase 1 ton to $1\frac{1}{2}$ tons.
 A Increase 2 tons to 3 tons
 B Decrease 3 tons to nil

TABLE 20.—CONTINUOUS CROPPING WITH f.y.m.

Yields in lb tubers or dry grain per acre.

<i>Treatments</i>			<i>Yams 1954</i> N.S.	<i>Benniseed 1953</i> N.S.	<i>Grains 1952</i> N.S.
Control	...	...	7411	100	729
A	...	...	8165	112	938
B ...	...	...	8262	108	870

Table 20 shows the yields for the first cropping cycle with the altered manurial rates. None of the differences was significant but it was not expected that the altered treatments would have much effect in the first cropping cycle.

(5) *Night Soil Compost, Samaru.*—A considerable tonnage of night soil compost is made at Samaru and its value compared with f.y.m. was tested for the second year. The test crop was guineacorn (Table 21).

TABLE 21.—NIGHT SOIL COMPOST *V* f.y.m.

Guineacorn yields in lbs grain per acre.

		1954	1953
		***	***
3 tons f.y.m. per acre	...	1453	1642
6 tons compost per acre	...	1176	1605
3 tons compost per acre	...	1020	1533
Nil	...	602	941
S.E. $\pm$	...	115	105
5% Sig. Diff.	...	346	318
1% Sig. Diff.	...	478	438
0.1% Sig. Diff	...	660	605

In both years all treatments were significantly better than nil. In 1953 there was no difference between the three manurial treatments but in 1954 f.y.m. was significantly better than 3 tons compost and yielded considerably more heavily than 6 tons compost. The difference may possibly be due to the fact that the compost is a much more variable product than f.y.m.

CULTIVATIONS

(1) *Hilling V Ridging, Bida*.—An experiment was started at Bida to compare, over a period, standard departmental 3-foot ridges with local 4½-foot ridges and the common local practice of planting on hills. The first crop was guineacorn which, having been planted without any manure, gave a very poor yield.

3 feet ridges	242 lbs grain per acre
4½ feet ridges	247 lbs grain per acre
Hills	215 lbs grain per acre

Plant populations were the same for each treatment.

WEED CONTROL

Control of Cynodon dactylon, Samaru.—After some thirty years of continuous cropping at Samaru the main obstacle to continued good yields is the grass *Cynodon dactylon*. Shortage of labour to control it in the early stages of crop growth reduces yields considerably. The fact that it is a useful fodder grass makes it all the more important to find out how to control it when required. Work done to date may be regarded as preliminary skirmishes. Disc ploughing in 1953 after the rains had finished seemed promising except that the ploughing was badly done leaving many ribs of untouched weed which, encouraged by a freak heavy rain in February, repopulated the area. Last dry season double discing in two directions was tried but again was done badly leaving many centres of infection. It seems however that even with an expert ploughman the land is too hard at this time to allow control by this method. Several chemical treatments were superimposed on this of which the most successful was Trichloracetate at the rate of 100 lbs. per acre. It was not completely successful due, probably, to the absence of rain after application, it is expensive and its effect on the following crop has still to be seen. Deep ploughing with a Durotrac plough was tried at the beginning of the 1955 wet season and seems promising though again the land was too hard for optimum cultivation. This method will be tried again at the end of the present wet season when the land should be in a better condition for ploughing. It is of interest that *Cynodon* is of minor importance on adjacent native farms but that these are heavily infested with *Imperata* grass which does not trouble us at all. *Cynodon* is however of major importance in the uplands of Southern Zaria province, where it is almost universal.

PART III.—BOTANY SECTION *Elizabeth*

By A. R. Maurer, E. Harrison and
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A.—WORK AT SAMARU

PERMANENT ROTATION PLOTS

This project was initiated in 1948 and consists of a straight rotation of Cotton, Guineacorn and Groundnuts. 3 tons f.y.m. is applied to the Guineacorn course.

The object is to record over many years the yields and general growth characters of the three crops and eventually to correlate these factors with climatic variation from year to year.

Table 22 compares yields, dates of planting, number of wet days, rainfall after 1st May and total rainfall for the seven years since 1948.

TABLE 22.— PERMANENT ROTATION PLOTS

Yields in lbs seed cotton, threshed corn and shelled nuts per acre.

Year	Cotton		Guineacorn		Groundnuts		No. of Wet days after 1st May	Rainfall after 1st May	Total Rainfall for year
	Planting Date	Yields	Planting Date	Yields	Planting Date	Yields			
1948...	2-7-48	449	28-5-48	1,665	25-6-48	1,209	84	<i>inches</i> 31.59	<i>inches</i> 35.31
1949...	6-7-49	305	28-5-49	1,424	24-6-49	1,200	67	38.43	38.93
1950...	3-7-50	472	25-5-50	1,355	23-6-50	1,209	79	34.54	35.39
1951...	5-7-51	431	6-6-51	1,243	22-6-51	666	93	44.47	45.67
1952...	3-7-52	175	6-6-52	743	13-6-52	1,441	83	43.24	43.51
1953...	3-7-53	70	5-6-53	316	13-7-53	225	79	45.56	46.25
1954...	3-7-54	72	14-6-54	121	30-6-54	66	86	52.20	58.34

The results are most discouraging. As it is known from the main farm that this type of land can be cropped continuously with the manuring and rotation in use it appears that increasing waterlogging is the cause of the falling yields. The area in which the rotation is sited has a series of soil conservation banks on the contour and the amount of water held on the land during August and September of the last two years virtually drowned the crops. It is possible that the effect is aggravated by compaction of the soil by mechanical cultivation. The present site has been abandoned and the series will be resumed by the Agronomist on Bush Plot No. 4.

GROUNDNUTS (*ARACHIS HYPOGAEA*)

(1) *Breeding Programme: (a) Hybridisation.*—Multiplying of hybrid nuts to quantities suitable for testing has continued during the year as has the harvesting of new hybrids.

The programme received a set back during the latter part of the year when three successive plantings in pots failed. In one case lizards removed the cotyledons and shoots of the sprouting nuts as they came through the ground. On another occasion small rodents caused considerable damage.

(b) *Selections*.—The new programme is now beginning to bear its first fruits. Results at Samaru and Kano are encouraging although selections planted at Daura generally fell short of what is required. Meanwhile it is interesting to note the progress of strain 14 T 12 a product of the old selection system. Table 24 shows its performance in 1954.

(c) *Introductions*.—During the year groundnuts were introduced from Hong Kong, South Africa, Sierra Leone and the Argentine. Particular interest was centred on those from Buenos Aires as they included two diploid species *Arachis villosa* and *Arachis duranensis*. The former has grown well under our conditions (except during the harmattan) and has flowered profusely but as yet no seed has been set. *Duranensis* although never seeming to do well vegetatively has set seed which has since germinated.

It is hoped to form a fairly large collection of diploid species. They will be used for chromosome studies and later for the production of artificial polyploids and subsequent hybridisation with some of our established tetraploid varieties. This long term project may yet prove to be the only solution to disease resistance if ready made resistant material proves to be unavailable.

(2) *Groundnut decortication*.—A small decortication trial was carried out early in 1955 to compare quality and output under two systems.

The traditional pestle and mortar method was compared with decortication by treading with bare feet in a large earthenware pot of nuts which had been previously moistened overnight.

Results showed that the treading method gave 65% whole kernels as compared with 35% using pestle and mortar. Output of the latter however was double that of the treading method.

(3) *Variety Trials: (a) Groundnut variety trial A1 (54)*.—Reporting this trial in last years annual report it was mentioned that one difficulty that arose in assessing the true value of groundnut varieties in trial, was that they seemed to change places in the table very erratically each year. "Mache Atsugune", the report went on to say, "included for the first time has done particularly well and is in top position in the table". This year it must be reported that Mache Atsugune is in bottom place.

The result this year was not significant. Some of the "L" selections however, included for the first time, gave a good account of themselves Table 23 shows the yields and also the relative positions of varieties over the years and the 1946-54 average.

(b) *Groundnut Variety Trial II*.—To replace six of the "L" selections which moved up into the main variety trial a number of selections made by the Botanist in 1949 were included as was the East African variety Mwitunde. These selections had previously shown promise in various small trials and here their yields were compared with Castle Cary and Samaru 38. The variety 14 T 12 which has shown exceptional promise in the past again yielded well being significantly ($P=.01$) better than Samaru 38. The strains L 126 and L 200 were also significantly ($P=.05$) better than Samaru

38. The variety Mwitunde included for the first time in a yield trial gave quite a reasonable account of itself considering the seed was in poor condition. Table 24 gives the adjusted yields for incomplete blocks in descending order.

TABLE 23.—GROUNDNUT VARIETY TRIALS MAIN, SAMARU, 1946-54.

<i>Year No. of Varieties</i>	1946 25	1947 25	1948 12	1949 15	1950 15	1951 15	1952 15	1953 15	1954 15	1954 Shelled nuts	1946-54 average in lbs acre Shelled nuts
L245 ...	—	—	—	—	—	—	—	—	2	1,117	(1,117)
Mache Atsugune	—	—	—	—	—	—	—	2	15	905	1,094
Castle Cary	10	6	1	6	4	9	12	9	1	1,135	1,081
L250 ...	—	—	—	—	—	—	—	—	4	1,071	(1,071)
MG371 ...	4	20	5	10	11	4	11	8	3	1,116	1,069
MJ374 ...	1	7	2	4	3	13	2	10	5	1,069	1,048
Samaru 38	11	5	4	12	5	6	7	3	7	1,037	1,045
MK383 ...	15	2	7	2	1	2	9	4	10	1,016	1,043
MJ371 ...	2	10	6	3	2	5	1	13	6	1,044	1,037
L60 ...	—	—	—	—	—	—	—	—	8	1,030	(1,030)
Kano 50 ...	—	—	—	—	9	3	5	5	9	1,026	1,026
MK374 ...	5	3	11	5	8	12	10	1	12	978	1,012
L235 ...	—	—	—	—	—	—	—	—	11	1,011	(1,011)
ML372 ...	2	15	12	11	15	10	14	6	13	977	995
L234 ...	—	—	—	—	—	—	—	—	14	956	(956)

Columns 2-10 show the relative positions of all the varieties in the year named.

Columns 11-12 show yields in lbs per acre. Brackets in column 12 indicate varieties included in 1954 for the first time.

TABLE 24.—GROUNDNUT VARIETY TRIAL II

<i>Varieties</i>	<i>Adjusted yields of kernels lbs/acre</i>					
	**					
14 T 12 ...	...	...	...	...	...	794
Castle Cary	...	...	...	...	...	779
L 126 ...	...	...	...	...	...	743
L 200 ...	...	...	...	...	...	739
18 B 138 ...	...	...	...	...	...	713
15 A 167 ...	...	...	...	...	...	703
17 B 62 ...	...	...	...	...	...	691
L 258 ...	...	...	...	...	...	686
Castle Cary ex Bida	...	...	...	...	...	668
Mwitunde	...	...	...	...	...	657
Mache Atsugune	...	...	...	...	...	634
L 121 ...	...	...	...	...	...	614
Samaru 38	...	...	...	...	...	594
Yipa ...	...	...	...	...	...	582
Tudun Wada	...	...	...	...	...	457
S.E. ...	...	...	...	...	...	± 42
Sig. Diff. 5%	...	...	...	...	...	119
Sig. Diff. 1%	...	...	...	...	...	158

(c) *New Selections Trial*.—This trial the successor of the old Reselection trial includes the best yielders from the new selections of 1953 and progenies of earlier selections again tested against Samaru 38 and Castle Cary. Yields were rather low but one selection U 537MA did particularly well but was not significantly better than the standard varieties.

(d) *Variety Trial; Early Maturing Groundnuts*.—This trial was continued unchanged and the four premier varieties last year merely changed places. Phillipine White and Dixie Runner again proved to be later maturing than the others. Table 24 shows the yields for 1953 and 1954.

TABLE 25.—EARLY MATURING VARIETY TRIAL

Yields in lbs kernels per acre

<i>Varieties</i>						1954	1953
Dixie Runner	...	...	...	...	...	441	949
Spanish 205	...	...	...	...	...	415	953
279-6	...	...	...	...	...	389	1,134
278-4	...	...	...	...	...	387	970
Natal Common	...	...	...	...	...	356	880
Valencia	...	...	...	...	...	338	784
Toro	...	...	...	...	...	330	489
Kono	...	...	...	...	...	308	778
Phillipine White	...	...	...	...	...	263	773
S.E.	...	...	...	...	...	± 34	149
Sig. Diff. 5%	...	...	...	...	...	100	447

(4) *Seed Disinfection of Groundnuts*.—In this trial once again none of the treatments seem to have had a significant effect on yield although for the two years that the trial has been running germination after planting has been particularly good. Yields of the various treatments are given in Table 26.

It is intended to modify slightly this trial and groundnuts shelled by a "Cathala" hand decorticating machine are already under treatment. It is felt that some of the fumigants may prove their value when nuts are shelled by machine rather than by hand since in the former case much more damage is done to the testa.

TABLE 26.—SEED DISINFECTION

<i>Fumigants</i>	<i>lbs/kernels/acre</i>	<i>%Germination Count</i>
Gammexane	424	89.3
Carbon Disulphide	421	86.1
Control	395	85.3
Agroicide	393	90.2
Killoptera	375	87.5
Napthalene	359	89.7
Carbon tetrachloride	357	84.5
S.E.	± 22	

Not significant

(5) *Stock plot observation, groundnuts*.—Maintaining an ever increasing number of varieties in the stock plots has proved to be an ever increasing problem. So the stock plot observation trial was inaugurated to enable the more useless strains to be identified and subsequently discarded. Three blocks of replicated rows involving 20 varieties were planted and Samaru 38 and MJ 374 placed every 6th and 7th row, were used as standards.

Dormancy Observation.—The question of dormancy was raised by Agricultural Officer Bida. He maintained that on reaching maturity, groundnut seed (of any of the existing varieties) would germinate in the ground if heavy rains followed a dry spell. Castle Cary it seems was particularly affected at Bida whereas the local variety named “Ejawagi” was believed to possess the factor for dormancy.

In this connection 4 rows each of twenty eight of our main varieties of groundnuts were planted at Samaru and at Bida. Row A was used to determine the approximate date of maturity. Row B was then lifted and notes made on the number of nuts per plant, per row, and the number of immature nuts etc. Rows C and D were now well watered every two days. Row C was lifted after 2 weeks, row D after 4 weeks. Special notes were made in this case of any sprouted nuts present.

The observation was aided by the weather in that rain fell late in October and again in November.

Results showed that early maturing varieties such as Spanish 205, Natal Common, Valencia, Toro and Kono had all begun to sprout even after two weeks watering.

Varities Dixie Runner and Phillipine White generally regarded as semi-early maturing showed no sign of sprouting after four weeks of watering. In fact none of the 17 long season varieties tried, including Castle Cary, showed any sign of sprouting at the end of the treatment,

(6) *Mwitunde Rosette Observation*.—A small observation using 3 varieties of groundnuts in 3 blocks was laid out to test the rosette resistant variety Mwitunde, recently imported from Tanganyika. Three dates of planting were also incorporated.

Unfortunately the site chosen became extremely waterlogged during the rains so that useful records could not be made. It is intended to repeat the observation in 1955.

Genetical Observation.—As a modest start to a detailed study of *Arachis hypogea* a small isolated block of six varieties was planted. The object was to observe the amount if any of outcrossing that takes place in the field.

Using such characters as testa colour and habit of growth and correlating the results with those obtained by artificial crosses of potted plants it is hoped to work out some of the genetical relationships between the characters involved.

The varieties used were:

Tudun Wada	...	...	Red Testa	...	...	Spreading
Toro...	...	...	Red Testa	...	...	Upright
Phillipine White	...	...	White Testa	...	...	Spreading
Pearl...	...	...	White Testa	...	...	Upright
Dixie Runner	...	...	Flesh Testa	...	...	Spreading
Samaru 38	...	...	Flesh Testa	...	...	Upright

They were planted in a block as shown in Table 27.

TABLE 27.—LAYOUT OF GENETICAL OBSERVATION TRIAL.

	Upright	Spreading	Upright	Spreading	Upright	Spreading	
Flesh	6 Samaru 38	12 Phillipine White	18 Toro	24 Dixie Runner	32 Pearl	36 Tudun Wada	Spreading
White	5 Phillipine White	11 Toro	17 Dixie Runner	23 Pearl	29 Tudun Wada	35 Samaru 38	Upright
Red	4 Toro	10 Dixie Runner	16 Pearl	22 Tudun Wada	28 Samaru 38	34 Phillipine White	Spreading
Flesh	3 Dixie Runner	9 Pearl	15 Tudun Wada	21 Samaru 38	27 Phillipine White	33 Toro	Upright
White	2 Pearl	8 Tudun Wada	14 Samaru 38	20 Phillipine White	26 Toro	32 Dixie Runner	Spreading
Red	1 Tudun Wada	7 Samaru 38	13 Phillipine White	19 Toro	25 Dixie Runner	31 Pearl	Upright
	Red	Flesh	White	Red	Flesh	White	

At harvest each variety was carefully lifted and bagged separately. Any nuts not adhering to the plants were discarded. Every kernel of each plant will be planted in 1955 and notes made of its subsequent development.

MILLET (*Pennisetum typhoideum*)

(1) *Millet Early Maturing Yield Trial A8 (54)*.—Fifty five millet selections carried over from the 1953 trial and nine new selections were planted in a lattice design. Yields were higher than average and ranged from 1,256 to 2,120 lbs. of threshed seed per acre. Seven outstanding selections which exhibited both high yield and early maturity will be carried forward together with 12 others for a further trial in 1955. There was a difference of 20 days between the earliest and latest maturing strains in 1954.

(2) *Millet Early Selections Hybrids Trial A9 (54)*.—Sixteen crosses were made in 1953 between promising early maturing selections which had been selfed for four generations. These F1 hybrids were planted in a trial in 1954. Yields ranged between 1,663 and 1,079 lbs. per acre of threshed seed. Heterosis was exhibited in the form of luxuriant vegetative growth but yields were not as high as those in the early maturing yield trial.

Further trials will continue in 1955 and it is hoped to determine whether any of the selfed strains exhibit better combining ability than others. No conclusions can be reached on the basis of 1954 results as there were no significant differences in yields.

GUINEACORN (*Sorghum vulgare*)

(1) *Doctor Webster's Programme*.—Work with Doctor Webster's crosses between local and American varieties continues. Seed of two sorghum lines with cytoplasmic male sterility and of their fertile counterparts has been received from Doctor Webster. This seed is being used in the United States of America to obtain hybrid sorghums for increased yields. It may be possible to utilise this seed to obtain hybrids of Nigerian guineacorn; on the other hand attempts to produce cytoplasmic male sterility in Nigerian guineacorn may be unsuccessful as it is not closely allied genetically to the American varieties which exhibit this phenomenon.

(2) *American Sorghum Variety Yield Trial A17 (52) R54*.—This is the third year of this trial. Results confirm those of previous years and show that the varieties Ladore and Hegari give the best yields under Samaru conditions. The yield of Short Kaura can not be considered as representing its actual performance. It is one of our best Nigerian varieties and matures later than the American types, but in these trials it had to be left on its own for weeks after the earlier types had been harvested. Bird damage was therefore extensive and yields were reduced to almost nil.

Table 28 presents results obtained over the past three years.

TABLE 28.—AMERICAN SORGHUM VARIETY TRIAL

Yields in lbs grain per acre

	1952	1953	1954	<i>Average</i>

Ladore SA6712	1533	826	910	1090
Hegari ...	1733	588	811	1011
Sedan Red ...	817	390	749	652
Martin ...	930	349	600	626
Pink Kafir ...	1077	282	456	605
Midland ...	624	228	623	492
Gurno ...	679	228	465	457
Redbine 66 ...	617	149	509	425
Redland ...	705	100	434	413
Dwarf Shallu 5770	737	145	307	396
Dwarf Shallu 5651	626	207	328	387
Dwarf Kafir 44-14	475	74	386	312
Combine 60 ...	254	122	447	274
Short Kaura ...	—	15	31	23
S.E.	±105		± 54	

(3) *American Guineacorn Time of Planting Trial No. A7 (54).*—The object of this trial was to find the best time to plant early maturing American guineacorn varieties at Samaru. It was hoped that by later planting the heads would mature in the dry season as harvesting during the rains is very difficult. A series of similar trials was carried out at different stations throughout the region. Ladore and Hegari, the best varieties at Samaru, were planted at six different times at two week intervals, commencing at the normal time of planting guineacorn in the area. Yields are given in Table 29.

TABLE 29.—AMERICAN GUINEACORN TIME OF PLANTING TRIAL

Yields in lbs grain per acre

<i>Sowing date</i>	<i>Variety</i>		<i>Mean</i>
	<i>Ladore</i>	<i>Hegari</i>	
24/5/54	592	469	530
7/6/54	16	10	13
21/6/54	16	19	18
5/7/54	18	21	20
19/7/54	14	7	11
2/8/54	11	19	15

There are no significant differences between the two varieties. The first planting gave a good yield but later plantings failed. Practically identical results were obtained in the other experiments of the series. These varieties are not a practical proposition except perhaps in the extreme north where the rainy season is much shorter.

(4) *Guineacorn Variety Yield Trials Nos. A6 (54), A5 (54).*—These two experiments were planned as part of two sections, one of varieties from South of Samaru and the other of varieties from further North. Both trials were carried out at Samaru. It is hoped to find varieties which will perform well over a wide area.

The two Samaru experiments were planted on a site which later become very badly waterlogged and establishment and subsequent growth were poor. Yields were so low that the results are of no value.

MAIZE (ZEA MAYS).

Maize Variety Yield Trial A7 (52) R54.—In 1954 the last of a series of variety trials begun in 1952 by the Botanist *i/c* Maize at Ibadan was carried out at Samaru. Results obtained over the three years are presented in Table 30.

TABLE 30.—MAIZE VARIETY YIELD TRIAL
Yields in lbs threshed grain Per acre

<i>Variety</i>	1952	1953	1954	<i>Average</i>
	**	*	N.S.	
Indiana 90IA ...	1723	1242	1827	1597
Indiana Synthetic ...	1581	1347	1799	1576
Kansana Synthetic ...	1522	1226	1690	1479
Bomo local ...	1311	1000	2079	1463
Kansas 2234 ...	1664	1174	1490	1443
Kansas Synthetic ...	1439	1158	1726	1441
Belgian Congo ...	1169	1275	1617	1354
Zaria Market ...	1210	1335	1513	1353
Tsolo (open pollinated)	1049	1315	1642	1335
Maigana local ...	1091	1131	1617	1280
S. E. ...	±115	±179	±126	—
Sig. Diff. 5% ...	324	507	—	—
Sig. Diff. 1% ...	431	—	—	—

Differences were not significant in 1954.

RICE (ORYZA SATIVA)

The Rice Research Station at Bida took over all our rice varieties in 1954 and we have only retained the G79 nucleus stock for the Maigana Multiplication Scheme. This nucleus stock is maintained at the Samaru

Dam Site and is subject to close observation and drastic roguing to insure that purity is preserved.

SOYA BEANS (GLYCINE MAX)

(1) Experiments with soya beans which had to be curtailed in 1953 were resumed in 1954. Experiment A9 (52) R54 compared the performance of the same varieties that were tested in 1952.

Table 31 lists the yields obtained in soya bean variety trials at Samaru over the past few years.

TABLE 31.—SOYA BEANS VARIETY TRIALS

Yields in lbs seed per acre

<i>Variety</i>	1949	1950	1951	1952	1954	<i>Average</i>
Bilomi No. 3	—	—	1,148	1,174	946	1,089
Misc. 94 ...	—	—	1,088	1,154	819	1,020
Avoyelles ...	1,102	811	—	—	—	957
Benares ...	1,079	952	846	986	824	937
Yellow						
Bermeley ...	—	—	798	1,159	813	923
Malayan ...	1,032	—	—	1,038	601	890
Black Matted ...						
Java ...	—	—	983	974	709	889
Bilomi No. 1 ...	—	—	1,021	1,048	508	859
28 E.B. ...	—	—	—	980	706	843
Arcadian ...	935	646	—	—	—	791
Mamloxi ...	719	604	—	—	—	667
S.E. ...			±50	±264	±80	

The 1954 results were significant. Bilomi No. 3 has maintained its position as the highest yielding variety in our trials.

Variety 28 E.B. was found to be heterogenous and selection within this variety should lead to an improvement.

(2) *Maintenance*.—A total of 38 varieties were maintained in the stock plots in 1954. Yields ranged from 1238 lbs. of seed per acre for variety 28 E. B., strain 3910, to 133 lbs. per acre for Panyam.

SUNFLOWER (HELIANTHUS ANNUUS)

A variety yield trial (No. A12 (52) R54) was carried out in 1954 but due to severe waterlogging the experiment was a total failure. Actual yields were in the neighbourhood of 14 lbs. per acre of threshed seed.

TOBACCO (*NICOTIANA TABACUM*)

The year 1954 was exceptional for Tobacco at Samaru and we were able to grow a fine crop for the first time in several years.

The experimental and maintenance plots were sited on newly cleared land and farmyard manure was applied at the rate of 4 tons per acre. A top dressing of 1 cwt. of ammonium sulphate per acre was applied in early September.

Because of the heavy yields of leaf harvested a new tobacco-curing shed had to be constructed.

Variety field trial No. A8 (52) R54 compared the performance of ten introduced varieties and the standard Virginia Hybrid commonly grown in the North. Weights of cured leaves have not yet been obtained as the relative humidity of the air is still too low. No final results can therefore be presented at this time.

The 1953 results which could not be included in last year's report are presented in Table 32. It should be noted that the 1953 experiment was sited in a very poor location.

TABLE 32.—TOBACCO VARIETY TRIAL
Yields in lbs cured leaf per acre

					**
Gold Dollar	...	...	...	...	119
Virginia Hybrid	...	...	...	...	79
Yellow Mammoth	...	...	...	...	74
Cash	...	...	...	...	72
Heavy Western	...	...	...	...	40
Improved One Sucker	...	...	...	...	39
Lizard Tail Orinoco	...	...	...	...	28
S.E.					±15
Sig. Diff. 5% ...					43
Sig. Diff. 1% ...					58

The 1954 maintenance plots had a total of 55 varieties and strains and the performance of most of these was far above the average for Samaru. The tobacco is still in the barns awaiting more favourable climatic conditions for grading and final weighing to be carried out. It is estimated, however, that we will have almost 1,000 lbs. of cured tobacco from the 1.5 acres grown in 1954.

SUGAR CANE (*SACCHARUM OFFICINALE*)

Multiplication of introduced varieties said to be resistant to Red Rot continues at Samaru and Maigana. All varieties have now been inoculated with the pathogen but it will be several months before final results can be obtained.

Hot water treatment of canes to increase germination of buds has proved successful and is being continued.

CASSAVA (MANIHOT UTILISSIMA AND M. PALMATA)

Results of Cassava experiments must necessarily be presented for the previous year as harvesting does not take place until the month of June.

(1) *Cassava Mosaic Yield Trial*.—Due to an attack of *Fusarium equisiti* in this trial many plants had to be destroyed and complete records of yields are not available.

Yields were low for the second year in succession. This may be partly attributed to the siting of the experiment in a waterlogged area. Better results should be obtained in 1954-55.

The 1953 results confirm the high yielding potential of the Clones E2 and B18 when compared with CH50 and the local Dan Warri variety. These Samaru clones will now be sent to outstations for trial in Farm Gardens to compare with the local strains. The four clones B26, B21 A2 and B9 will be discarded.

(2) *Cassava Length of Cuttings Observation*.—Further observations were made on cuttings of Dan Warri Cassava. The sets were cut to lengths of 6", 9", 12" and 15" and planted in the usual way. Yields recorded from this trial are shown in Table 33 together with previous year's results.

TABLE 33.—CASSAVA LENGTH OF CUTTINGS OBSERVATION TRIALS

Yields in lbs tubers per acre

<i>Length of Cuttings</i>	1951-52	1952-53	1953-54	<i>Average</i>
12"	13635	10484	6756	10292
15"	12928	11272	6050	10083
6"	12827	6515	4235	7859
9"	8888	9999	3529	7472

It would appear that 12" to 15" is the optimum length for cassava cuttings at Samaru. The tests will be repeated with a different variety of Cassava in 1955.

(3) *Cassava Clones Yield Trial All (52) R53*.—This trial is a continuation of a series of experiments started in 1950 to test the yields of fifteen varieties. Details of the origin of the 15 strains were presented in last year's report.

The 1953 results are presented in Table 34 together with previous years' yields.

TABLE 34.—CASSAVA CLONES YIELD TRIAL

Yields in lbs tubers per acre

<i>Variety or Clone</i>	1950	1951	1952	1953	<i>Average</i>
	**	**	**	**	
CH50	13407 (1)	19219 (2)	7783 (2)	5766 (4)	11544
E2	12944 (3)	13807 (6)	8032 (1)	7483 (1)	10567
B18	10959 (5)	17451 (3)	7068 (4)	5901 (3)	10345
Dan Warri ...	8857 (8)	19421 (1)	6798 (5)	4571 (7)	9912
C15	13309 (2)	13161 (8)	5888 (6)	3896 (8)	9064
Two Cent ...	10794 (6)	13398 (7)	4390 (11)	5911 (2)	8623
B17	12715 (4)	12678 (9)	4191 (13)	3471 (10)	8264
C5	9843 (7)	14828 (5)	4424 (10)	2179 (14)	7819
CH28	8519 (9)	11504 (10)	5715 (7)	4696 (6)	7609
H1	6001 (11)	15193 (4)	4858 (8)	3780 (9)	7458
C23	3011 (13)	11386 (11)	7045 (3)	4976 (5)	6605
B26	—	7480 (12)	4306 (12)	3356 (11)	5047
B21	8107 (10)	7323 (13)	1890 (15)	2073 (15)	4848
A2	—	5428 (14)	4478 (9)	3095 (12)	4334
B9	5000 (12)	4593 (15)	3602 (14)	2526 (13)	3930
Sig. Diff. 5%	4756	5901	2021	1349	—
„ „ 1%	6422	7860	2691	1790	—

(Numbers in brackets indicate relative positions).

PLANT INTRODUCTIONS

During the year under review a total of forty-three introductions were received at Samaru. Among those received were:

- 8 Samples of groundnuts from Argentina, South Africa and Hong Kong
- 13 Samples of tomato seed from Canada and Australia
- 6 Samples of benniseed from India and Ceylon
- 4 Samples of Sorghum from United States of America
- 3 Samples of grass seed from South Africa
- 8 Samples of forage legumes from Kenya.

PESTS AND DISEASES

(1) *General*.—The beginnings of a plant pathology section were established under the Botanist. The laboratory was electrified during the year and equipment which had already been received from overseas was put into use. Plant diseases have been identified at Samaru and specimens sent to the United Kingdom for confirmation of diagnosis.

(2) *Red Rot of Sugar Cane (Colletotrichum)*.—This disease continues to take its toll in the cane-growing areas. A pattern has now been established and reports early in the year tend to minimise the extent of the disease while reports at harvest time show that the infection is severe in many cases. There has been a reduction in the number of cane crushers operating in some areas and farmers are selling more of their crop for chewing.

All the new varieties of cane believed to be resistant to Red Rot have been injected with the pathogen but findings are not yet available.

(3) *Groundnut Disease*.—Rosette disease continues to limit production of groundnuts in some parts of the Middle Belt. The variety Mwitunde, said to be resistant to Rosette in East Africa, was tested at Samaru and in Niger Province. The seed arrived in poor condition and planting was late so that the results obtained to date are not a good criterion on which to judge this variety.

Other groundnut diseases reported during the year were the usual leaf spot (*Cercospora personata*) and root rot (*Sclerotium rolfsii*). Leaf spot is particularly noticeable on the earlier maturing varieties but has little effect on the majority of our standard later-maturing types. Damage from root rot is usually very localised.

Blind nuts have been reported from widely scattered points. There is a possibility that these may be caused by "Empty pod" disease described by Bouffil and Jaubert at Bambey in Senegal. It is probable, however, that blind nuts are caused in some cases by the presence of Rosette and in other cases by lack of nutrients in the soil. The former condition is to be found in Niger Province while the latter has been observed in some of the sandy soils of Kano Province, especially at Dambata.

(4) *Cassava Diseases*.—Mosaic in cassava is widespread and no truly resistant varieties have been found. Some which we believed might have been free of the virus have come down with the infection.

An infection of wilt, *Fusarium equisiti* was found in a field at Samaru and caused considerable damage to one of the experiments. All infected material was destroyed and the disease has not reappeared.

(5) *Citrus Diseases*.—Gummosis has taken a considerable toll of citrus grafted on Rough Lemon stock at Maiduguri. The disease is particularly serious where flooding occurs.

Elsinoe fawcetti was severe on seedlings of Rough Lemon at several nurseries throughout the region in October and November 1954.

Nutrient deficiencies on citrus have been reported from many parts of the North.

(6) *Eelworms*.—Root knot eelworm infestation has been found on many plants and has caused serious damage in many cases. Specimens from

diseased yams near Yandev were identified at Rothamstead as *Meloidogyne incognita*. A severe infestation at Kano ruined a tomato trial. Specimens of the eelworm from these plants have not yet been identified.

(7) *Sphacelotheca sorghi*; *Copper Carbonate Propaganda*.—The propaganda initiated by this section at Agricultural Shows to encourage the use of copper carbonate against covered smut of guineacorn has been well accepted and the demand far exceeded that of the previous year. The handling of copper carbonate at shows has now become too large an affair for this section and is being taken over by extension workers.

(8) *Insect Pests*.—Locusts were reported in Bornu Province during the year and were brought under control by the Federal Entomologists.

Cantharids sp. caused damage to trees and vegetable crops at Samaru.

The bush locust⁺ *Phymateus karshi* was found in many areas. At Samaru it caused considerable damage to hedges and other plants.

A full report on pests can not be presented as no Government Entomologist is posted to this Region.

NURSERY WORK AND ORCHARD

(1) *Ornamentals*.—Once again demand for ornamental shrubs and trees was in excess of the supply. Young plants were sent out to many stations in the North including Kano, Daura, Minna and Kafinsoli. At Samaru planting up Senior Service compounds with trees and hedges continued. The plants have to be well watered throughout their first dry season.

Seradix A, a rooting hormone in a concentrated liquid form, was used in effecting easier propagation of ornamentals. Generally speaking it was not so successful as the powder form previously used and which the staff find easier to apply.

Mealy bugs caused damage among young stands of *Duranta Blue* and *Acalypha*. They proved particularly difficult to eradicate and cutting off and burning all affected parts of plants proved in the end to be the most effective control. At one stage Cantharides beetles were causing severe damage to Passion fruit vines but were successfully dealt with by the Cotton Entomologist.

(2) *Vegetables*.—Further trials were carried out on new varieties of vegetables which were imported during the year. In particular tomato varieties from Australia and Canada were tested. Some of these proved to be dwarf in habit, produced very irregular fruit and were generally unsuitable to our needs. Plantings of turnips, cabbage and radish were seriously damaged by caterpillars and larvae of *Depidopterous* species.

(3) *Citrus and Other Fruits: Propagation*.—Here again demand far exceeded supply. The Policy is that the main function of the nursery at Samaru is experimental work and budded trees are first used to provide nucleus stocks for nurseries being newly set up. Only trees in excess of this need are available for normal distribution.

Heavy waterlogging of the nursery during the rains caused severe losses amongst newly budded trees and many died back altogether. A trained operator had good success in dry season budding when he shaded the new buds with Mango leaves tied around the stock. This seemed to prevent the buds drying out too quickly even in the harmattan.

Waterlogging and high winds also caused heavy losses amongst Pawpaw stands in the nursery. These have since been replaced and seedlings of the varieties Olile Jose, Dahomey and Florida are now ready for general distribution.

Seedling trees of Avocado Pears have been successfully raised and are ready for budding. Bud wood of Avocado and Mango which did not arrive last year is expected at an early date.

As in previous years Samaru has supplied seeds of Rough lemon and Tangelo to many Outstations.

(4) *Loranthus*.—A campaign was initiated to reduce to a minimum the amount of mistletoe (*Loranthus sp.*) on citrus and ornamental trees within Samaru boundary. Infected branches were cut out on all but a few trees which are for the moment inaccessible. It is hoped to repeat this operation within a few months.

B.—WORK AT OUTSTATIONS

Trials were again conducted at a number of outstations. Results were rather disappointing with Guineacorn but useful information has nevertheless been gathered.

GROUNDNUTS

Work at outstations is confined mainly to variety yield trials and eight such trials on groundnuts were laid down during 1954. Three of these were failures and the results were not analysed.

Groundnuts were planted in farm gardens at twelve outstations, and the results are already proving their value in indicating suitable varieties to go into further trials. With care they are also useful in the initial multiplication of strains and varieties in short supply.

(1) *Groundnut Variety Trial 1, Kano*.—This trial was repeated in exactly the same form as in the previous year. The trend established in 1953 was continued. MK 383, Kano 50 and MK 374 were significantly better yielders than Local Spreading, Spanish 205 and Natal Common.

The variety MK 383 is showing particular promise not only at Kano but also at Samaru.

Table 35 shows 1953 and 1954 yields and the relative positions of the varieties in 1953.

TABLE 35.—GROUNDNUT VARIETY TRIAL
Yields in lbs kernels per acre

<i>Varieties</i>						1954	1953
						***	***
MK 383	...	...	...	...	...	941	1,261 (1)
MD 351	...	...	...	...	...	845	1,064 (3)
MK 374	...	...	...	...	...	837	1,227 (2)
Dixie Runner	...	...	...	...	...	578	1,051 (4)
Natal Common	...	...	...	...	...	544	621 (6)
Spanish 205	...	...	...	...	...	477	540 (7)
Local Spreading	...	...	...	...	...	444	874 (5)
S.E.	...	...	...	...	...	± 52	± 50
Sig. diff. 5%	...	...	...	...	...	151	143
Sig. diff. 1%	...	...	...	...	...	203	193
Sig. diff. 0.1%	...	...	...	...	...	269	255

(2) *Groundnut Variety Trial II, Kano*.—A second variety trial was initiated at Kano in 1954. This aimed at comparing the yields of six strains of the Botanist's "L" selections with Kano 50, Samaru 38 and Kano 38. Results were not significant and the trial is to be repeated. Results are shown in Table 36.

TABLE 36.—GROUNDNUT VARIETY TRIAL II, KANO
Yields in lbs kernels per acre

<i>Varieties</i>						<i>Yields</i>
						N.S.
L 235	...	...	...	...	...	883
L 250	...	...	...	...	...	838
Kano 50	...	...	...	...	...	807
L 245	...	...	...	...	...	791
Kano 38	...	...	...	...	...	791
L 60	...	...	...	...	...	762
L 260	...	...	...	...	...	742
L 234	...	...	...	...	...	701
S 38	...	...	...	...	...	583
S.E.	...	...	...	...	...	± 61

(3) *Groundnut Variety Trial, Kiru*.—A very small yield trial comparing Castle Cary, Samaru 38, Kano 50 and local spreading was laid down at Kiru Settlement. Kiru lies midway between Zaria and Kano and the purpose of

the trial was to find whether Samaru 38 or Kano 50 was most suited to the area. (Table 36 shows that Samaru 38 does not yield well at Kano). The result was not significant and due to the fact that communications make it impossible to supervise the experiment either from Kano or Samaru it is not to be repeated.

(4) *Groundnut Variety Trial, Yandev*.—The variety trial at Yandev which was a complete failure in 1953, due to a devastating attack of rosette, was repeated in 1954 and a positive result obtained. The trend established in 1952—in that the early maturing varieties outyield the later maturing ones—was again evident.

This year Natal Common and Spanish 205 produced significantly better yields than all the later maturing types included. However, if yield of haulms is considered, the early maturing varieties which tend to drop many of their leaves before harvest produce far less bulk than the late varieties whose leaves are still green at harvest and remain attached to the plant.

Table 37 gives a Summary of yields over the last 3 years.

TABLE 37.—GROUNDNUT TRIALS, YANDEV
Yields in lb kernels per acre

<i>Varieties</i>	1952 <i>Kernels</i>	1953 <i>Kernels</i>	1954 <i>Kernels</i>	<i>Haulms</i>
	**		***	***
Natal Common ...	779	141	663	1,088
Spanish 205 ...	858	175	629	1,093
Dixie Runner ...	780	123	506	1,324
MK 383 ...	798	79	409	1,374
MJ 371 ...	759	60	375	1,416
ML 372 ...	679	44	305	1,470
Castle Cary ...	698	32	255	1,475
Yandev Local ...	510	60	128	1,191
S.E. ...	± 52		± 50	± 69
Sig. Diff. 5% ...	151	Not	144	201
Sig. Diff. 1% ...	204	Analyzed	195	271
Sig. Diff. 0.1% ...	—		263	365

(5) *Groundnut Variety Trials, Zonkwa*.—Two variety yield trials were laid down at Zonkwa one containing 9 early maturing varieties the other 9 late maturing varieties. Both trials were a complete failure due to water-logging, *Cynodon* and rosette.

(6) *Groundnut Variety Trial, Kontagora*.—The variety trial at Kontagora was ruined by rosette for the second year running despite early planting.

Observations seem to suggest that some special factor is involved at the experimental site and this will need to be investigated before further variety trials are laid down.

(7) *Observation on Rosette Resistant Varieties, Kontagora*.—An observation trial similar to the one at Samaru compared the yield of two varieties said to have some resistance to rosette with Samaru 38. The resistant varieties were Mwitunde from East Africa and Kontonkoro a type grown locally.

The Mwitunde seed arrived late and was not in particularly good condition; the resulting stand count was correspondingly poor. Rosette attack was heavy as is inevitable with late planting in that area and yields were low. The yield of nuts from Mwitunde compared favourably with that of Kontonkoro and Samaru 38. But in view of the low yields no definite conclusions may be drawn.

(8) *Groundnut Variety Trial, Kafinsoli*.—Nine varieties which had shown promise in the farm garden were planted in a yield trial, at the farm centre. They included Castle Cary and local spreading as standards. Yields were well above average although results were not significant. This is the first of a series of trials at Kafinsoli which will be slightly modified from time to time as the less successful varieties are excluded.

Table 38 shows the 1954 results.

TABLE 38.—GROUNDNUT VARIETY TRIAL, KAFINSOLI
Yields in lbs kernels per acre

<i>Varieties</i>						<i>Yield</i>
						N.S.
MG 371	...	...	...	...	...	1,245
Kano 50	...	...	...	...	...	1,224
Castle Cary	...	...	...	...	...	1,211
ML 3710	...	...	...	...	...	1,153
Tudun Wada	...	...	...	...	...	1,143
Dixie Runner	...	...	...	...	...	1,121
Yar Karachi	...	...	...	...	...	1,104
MJ 374	...	...	...	...	...	1,082
Local spreading	...	...	...	...	...	1,037
S.E.	...	...	...	...	...	±93

Dormancy Observation, Bida.—The Dormancy trial was a complete failure as it was so diseased at harvest time that many of the plants had produced “blind nuts” only. However the results obtained in the same trial at Samaru (page 22) seem to answer the question satisfactorily.

GUINEACORN (SORGHUM VULGARE)

(1) *American Sorghum Time of Planting Trials*.—Time of planting trials similar to the one conducted at Samaru were carried out at Yandev, Zonkwa, Maiduguri, Daura and Kano. There were six planting dates at two week intervals at all stations except Zonkwa and Yandev where seven dates were used. The dates were not similar at all stations because of variations in climatic conditions. Table 39 shows the proposed dates of planting at all stations conducting the test.

TABLE 39.—DATES OF PLANTING OF AMERICAN SORGHUM AT SIX STATIONS

Station	Exp. No.	1st	2nd	3rd	4th	5th	6th	7th
Maiduguri	UA4 (54)	7/6	23/6	7/7	21/7	4/8	18/8	—
Daura ...	D2 (54)	28/5	24/6	12/7	26/7	9/8	23/8	—
Kano ...	K7 (54)	13/5	27/5	11/6	25/6	9/7	23/7	—
Zonkwa ...	Z6 (54)	9/6	23/6	7/7	21/7	4/8	18/8	1/9
Yandev ...	V6 (54)	22/6	6/7	20/7	3/8	17/8	31/8	14/9
Samaru ...	A7 (54)	24/5	7/6	21/6	5/7	19/7	2/8	—

At Yandev seed for the last two planting dates was lost so that only five sowings were carried out.

Two varieties were used for these tests at each station but they varied between stations because of shortage of seed. Those used were the highest yielding American Sorghums we have.

Table 40 presents the yields obtained at six stations. In every case the mean yield of the two varieties is shown.

TABLE 40.—YIELDS OF AMERICAN SORPHUMS AT SIX STATIONS—TIME OF PLANTING TRIALS
Yield in lbs grain per acre

Date	Maiduguri	Daura	Kano	Zonkwa	Yandev	Samaru
1st ...	1,222	463	417	35	267	530
2nd ...	790	145	132	48	242	13
3rd ...	*	19	7	22	93	18
4th ...	*	12	3	20	96	20
5th ...	*	—	—	14	96	11
6th ...	*	—	—	—	**	15
7th ...	—	—	—	—	**	—

** not planted

* yields said to be too low, not recorded.

It is apparent from the above figures that late planting of American Sorghum is undesirable. The only good yield from the second date was obtained at Maiduguri. All the varieties used behaved in the same way.

These early maturing varieties do not fit into the local system of agriculture as they ripen during the wet season and go mouldy before they can be dried.

(2) *Regional Guineacorn Variety Yield Trials*.—A series of trials was carried out at Daura, Kano, Gusau, Maiduguri, Bida, Kontagora, Zonkwa, Yandev and Samaru. These trials compared the performance of various varieties of guineacorn originating either in the Northern Belt or the Middle Belt. It was hoped to determine whether any specific varieties could be recommended over a wide area. The position existing at the present time is that each village has its favoured strain which is maintained by farmers who save their own seed. Nigerian sorghum is considered to be autogamous and farmers have, over the years, produced numerous local pure-line strains by their conscious selection of good heads for seed. Under these conditions it has not been possible in the past to make recommendations for large areas.

Table 41 presents the yields in pounds of threshed grain per acre for all the experiments.

TABLE 41.—REGIONAL GUINEACORN VARIETY YIELD TRIALS

Yields in lbs grain per acre

<i>Varieties</i>	<i>Origin</i>	<i>M</i>	<i>G</i>	<i>K</i>	<i>D</i>	<i>S</i>	<i>Average</i>
<i>Northern Varieties</i>							
Shambul	<i>M</i>	1781 (4)	**	**	317 (1)	15 (5)	546
Farar	<i>D</i>	1319 (2)	264 (4)	355 (3)	261 (2)	35 (2)	497
Kaura			298 (3)	573 (1)			
Short	<i>S</i>	15 (6)	97 (5)	36 (5)	0 (6)	7 (6)	31
Kaura							
F.C.	<i>G</i>	52 (4)	445 (2)	367 (2)	89 (5)	31 (3)	197
Standard							
Yar Gunki	<i>K</i>	32 (5)	476 (1)	367 (2)	96 (4)	21 (4)	198
Loose	<i>G</i>	56 (3)	445 (2)	331 (4)	98 (3)	47 (1)	195
Fatafara							
<i>Varieties</i>	<i>Origin</i>	<i>S</i>	<i>Ko</i>	<i>Y</i>	<i>Z</i>	<i>B</i>	<i>Average</i>
<i>Middle Belt Varieties</i>							
Farafara	<i>S</i>	**	***	***			
Farafara	<i>Ko</i>	763 (1)	509 (5)	1089 (1)	306 (4)	122 (1)	558
Tall		676 (2)	726 (2)	618 (3)	351 (3)	77 (2)	490
Kaura	<i>S</i>	513 (3)	555 (4)	510 (4)	516 (1)	43 (4)	425
Akuli ...	<i>Y</i>	77 (6)	1027 (1)	466 (5)	359 (2)	27 (6)	391
Yernarc	<i>Z</i>	248 (4)	695 (3)	705 (2)	359 (2)	32 (5)	408
Agyan	<i>Z</i>	123 (5)	475 (6)	313 (6)	238 (5)	54 (3)	241

M—Maiduguri, G—Gusau, K—Kano, D—Daura, S—Samaru, Ko—Kontagora, Y—Yandev, Z—Zonkwa, B—Bida.

Short Kaura, which is one of our heaviest yielding varieties, suffered from inadequate discards resulting in heavy shading from the other much taller varieties. As well as reducing yield this also delayed maturity so that the variety was alone in the field after the others had been harvested and was exposed to damage by predators.

Of the Northern Belt guineacorns, the varieties originating in the Far North performed better on the whole than those from further South at Daura, Maiduguri and Kano.

Of the Middle Belt group, Samaru Farafara appears to be the most adaptable type when all stations are considered. Other varieties have, however, performed well at particular stations. No definite conclusions can be reached from this series of experiments.

SOYA BEANS

(1) Soya beans are grown as a cash crop in parts of the Middle Belt and may eventually replace groundnuts in areas which suffer extensive Rosette attack. A variety yield trial was planted at Kontagora Groundnut Farm and yields of some of the varieties are considered satisfactory. These yields are about the same as those obtained at Yandev.

(2) *Soya Bean Variety Yield Trial, Kontagora*.—Nine varieties of Soya beans from Samaru were tested in a yield trial to determine the varieties best suited to conditions in this area. Table 42 shows yields of threshed beans in lbs. per acre.

TABLE 42.—SOYA BEAN VARIETY TRIAL
Yields in lbs per acre

<i>Variety</i>					<i>Yield</i>

Yellow Bermelly	...	...	...	...	752
Dixie	...	...	...	...	669
Misc. 94	...	...	...	...	634
28 E.B.	...	...	...	...	606
Benares	...	...	...	...	544
Malayan	...	...	...	...	541
Black Matted Java	...	...	...	...	438
Bilomi No. 3	...	...	...	...	406
Bilomi No. 1	...	...	...	...	42
S.E.	...	...	...	...	+52
Sig. Diff. 5%	...	...	...	...	150
Sig. Diff. 1%	...	...	...	...	201
Sig. Diff. 0.1%	...	...	...	...	266

The yield of Bilomi No. 1 was too low to be included in the analysis.

On the basis of these results Yellow Bermelly would appear to be the variety best suited to Kontagora.

(3) *Soya Bean Variety Trial, Yandev*.—A variety trial was carried out at Yandev for the third successive year. Yields in 1954 were better than those obtained in the previous year. Table 43 presents the results obtained in the past three years.

TABLE 43.—SOYA BEAN VARIETY YIELD TRIAL, YANDEV

Yields lbs beans per acre

<i>Varieties</i>	1952	1953	1954	<i>Average</i>
	**	***	**	
Malayan	834	336	621	597
Bilomi No. 3	724	315	692	577
Yellow Bermelly	760	271	691	574
Misc. 94	543	322	723	529
Black Matted Java	672	249	604	508
Bilomi No. 1	555	214	622	464
Dixie	648	225	510	461
28 E. B.	614	273	466	451
Benares	624	216	511	450
S.E.	±48	±23	±50	—
Sig. Diff. 5%	135	65	142	—
Sig. Diff. 1%	180	87	191	—

In 1954, Misc. 94, Bilomi No. 3 and Yellow Bermelly have yielded significantly higher than Benares, Dixie and 28 E.B.

Over the three years of the trials, Malayan, Bilomi No. 3 and Yellow Bermelly have been outstanding.

It is interesting to note that the variety Benares which was used in the past as the standard one and which has been distributed throughout the province, has given the poorest yields. On the basis of the above results a programme of multiplication of Malayan has been started to replace Benares in Benue Province.

BENNISEED (*SESAMUM INDICUM*)

(1) *General*.—The Benniseed selection programme continued at Yandev. This work aims at producing pure lines which are (a) earlier maturing, *i.e.*, reaching maturity within 80-90 days, and (b) heavier yielding.

A. O. Yandev has distributed some of our improved lines to farmers and reports that they are pleased with them.

(2) *Early Selections, Family V Strains Trial.*—This trial was designed to test the earliness of strains selected within twelve families and to test the families themselves.

The experiment could not be analysed statistically due to the great variation in stand count. Yields by families are shown in Table of 44. The comparable figures for 1952 and 1953 are also presented.

TABLE 44.—YIELDS OF FAMILIES OF BENNISEED SELECTED FOR EARLINESS

Yields in lbs seed per acre

<i>Family</i>	<i>Strains</i>	<i>Yield</i> 1952	<i>Yield</i> 1953	<i>Yield</i> 1954	<i>Average</i>
		**	**		
A	189	374	125	194	231
D	66	299	80	259	213
H	109 and 167	347	74	213	211
J	120 and 4	311	70	233	205
E	66	273	82	240	198
Unselected	—	293	94	179	189
G	172 and 192	236	55	246	179
C	152	265	71	194	177
B	137	280	117	115	171
F	181 and 98	259	73	152	161

In 1954 most of the families showed less variation than the control. Family B was poor, low yielding and with a low proportion of early stands. Families D, G and J were the best performers taking both earliness and yield into consideration.

(3) *Normal Maturity, Benniseed Yield Trial.*—This experiment was designed to test the yielding ability of three selections which have shown promise for several years. These were tested with Yandev unselected seed as a control.

Table 45 presents results obtained since 1952.

TABLE 45.—BENNISEED NORMAL MATURITY YIELD TRIALS

Yields in lbs seed per acre

<i>Strain</i>	<i>Yield</i> 1952	<i>Yield</i> 1953	<i>Yield</i> 1954	<i>Average</i>
064	453	273	417	381
055	501	234	338	358
0361	—	230	361	296
Unselected	428	230	328	329

Results have not been statistically significant in any year but there is an indication nevertheless that the selections are, on the whole, higher yielding than the local unselected seed.

RICE

G79 Multiplication Scheme.—Since 1952 when this section was assigned the task of improving the purity of G79 rice grown in the North, a considerable improvement has been effected.

Principles of mass-selection have been used to eliminate wild species and native varieties of rice from the fields. Purity checks are conducted in the laboratory on seed from the Maigana multiplication scheme and from outstations. Emphasis is placed on the Maigana scheme as this seed is used as the nucleus stock for all other schemes in the region.

Table 46 shows the results obtained in purity checks made in the laboratory.

TABLE 46.—PURITY TESTS ON G79 RICE

<i>Station</i>	<i>Province</i>	<i>% Impurity</i>
Stage 0 Maigana	Zaria	0%
Stage 1 Maigana	Zaria	0%
Stage I Zonkwa	Zaria	0.33%
Stage II Zonkwa	Zaria	2.0%
Yelwa	Zaria	2.0%
Kerawa	Zaria	1.66%
Gadagan	Zaria	3.00%
Wusasa and Sakadadi	Zaria	3.33%
Anchau	Zaria	3.67%
Pategi	Ilorin	0%
Jere Bowl	Bornu	9.66%
Yola	Adamawa	15.33%
Ajikamai	Niger	1.33%
Shemanker	Plateau	2.67%

SUGAR CANE (*SACCHARUM OFFICINALE*)

Sugar Cane Variety Trial, Maigana.—The series of variety trials of sugar cane at Maigana was continued in 1954. The varieties tested were some of the older introductions as the new varieties believed to be resistant to Red Rot had not yet been fully tested against the pathogen.

Red Rot again took its toll. The local variety was most severely affected by this disease indicating that the others contain a factor for resistance or tolerance. Waterlogging was severe during part of the wet season and reduced yields in some plots.

Table 47 presents yields of canes in lbs. per acre. Table 48 presents yield of cane sugar per acre and percentage of sugar.

TABLE 47.—SUGAR CANE VARIETY TRIAL
Yield in lbs cane per acre

<i>Variety</i>	1952-53	1954-55	<i>Average</i>
CO 331	21280	26100	23690
No. 3	—	21451	(21451)
No. 5	12523	25726	19125
Uba	20025	17635	18830
CO 213	14520	22318	18369
No. 8	13269	21891	17580
No. 4	14762	—	(14762)
Local	—	11306	(11306)
S.E.		±3597	

Yield of local was not included in the analysis. There were no significant differences in yields.

TABLE 48.—YIELD OF CANE SUGAR PER ACRE AND PERCENTAGE OF SUGAR

<i>Variety</i>	<i>Yield of Cane Sugar 1952-53</i>	1952-53 % Sugar	<i>Yield of Cane Sugar 1954-55</i>	1954-55 % Sugar	<i>Average Yield of Cane Suga</i>
	*		N.S.		
Uba	1280	6.4	376	2.13	828
CO 331	854	3.5	675	2.59	765
CO 213	784	5.4	676	3.03	730
No. 4	607	4.1	—	—	(607)
No. 8	713	5.4	443	2.02	578
No. 5	462	3.7	509	1.98	486
No. 3	—	—	281	1.31	(281)
Local	—	—	241	2.13	(241)
S.E.	±142		±113		
Sig. Diff. 5%	414		—		

The percentage of sugar produced by all varieties in the 1954-55 trial was lower than that produced in 1952-53. The yield of sugar per acre was therefore lower on the whole although the amount of cane harvested was greater. This may be partly due to an extremely wet season.

PART IV.—CHEMISTRY SECTION

By H. Irving

A.—GENERAL

There was no change in the buildings housing the Chemistry section. The buildings were however wired for alternating current from the Electricity Corporation of Nigeria, Zaria Undertakings in April and May. The final change over from the section's D. C. supply was made in July. New equipment previously ordered for the new electricity supply was connected and has resulted in a marked increase in the number of determinations completed by the laboratory staff.

B.—LABORATORY WORK

The laboratory carried on the normal routine analysis of pasture grasses, feeding stuffs, fertilizers etc., in connection with various experiments for other sections. A complete analysis of over 450 grass samples was made for the Grassland Section. Regular analysis of all types of citrus juice has become another weekly routine for the Botanist Section. In addition to these, special projects have also required considerable laboratory work for the Provincial Agricultural Officers.

The laboratory staff have also completed analyses of a large number of soil samples taken in connection with the various soil surveys undertaken during the dry season. The details of the analyses will be included in the final Soil Survey Report of each area. Soils have also been analysed for the Engineering and Irrigation sections, for their suitability for use in building dams.

C.—GENERAL EXPERIMENTS

(1) *Standard D.N.P.K. Trials.*—The standard series of trials incorporating annual dressings of f.y.m., nitrogenous, phosphatic and potassic fertilisers were continued at Daura, Kano, Daudawa, Samaru, Bida, Yandev and Maiduguri with the current crop of the local rotation.

The 1954 crop at Daura should have been groundnuts but due to an error, the grain crop was sown for the third consecutive year. The yield were very low in comparison to normal grain crops on the farm and the statistical analysis was not considered valid for the experiment. The groundnut crop at Bida was a failure, and no data are available. The current test crop for Maiduguri was cassava which had not been harvested at the time of preparation of this report. The data from all the stations excluding the three cases mentioned above are presented in Table 49, which shows the responses to the different treatments.

In the 1953-54 report (Table 38) reference was made to the first indication of a detrimental effect on yield due to the continued high level application of superphosphate at Kano and Yandev. This effect was not reproduced in

the 1954-55 trials at either station, and for the time being the suggestion of the detrimental effect may be considered as a chance effect. Likewise the same indication for the first time this year at Samaru, with the higher dressing of superphosphate on Guineacorn, will be considered a chance effect until more consistent figures are available.

The results as a whole follow the trend of past years. A highly significant increase in yields from applications of f.y.m. was obtained for all crops at all stations. The same trend is also shown by superphosphate but the increases are of a much lower order. The nitrogen response is variable according to the test crop. The highly significant increase due to potash, in haulm yield of groundnuts at Kano was unexpected and must for the present be considered as a chance effect.

TABLE 49.—D.N.P.K. TRIALS
Yields and Differences in lbs per acre

Station	Kano		Daudawa	Samaru	Bida	Yandev
Treatment	Groundnuts Kernels	Haulms	G'corn Grain	G'corn Grain	G'corn Grain	G'corn Grain
F.Y.M. ..	***	***	***	***	***	***
D ₀ ..	771	1,636	891	744	509	456
D ₁ ..	+336	+359	232	+458	+331	+324
D ₂ ..	+455	+712	+396	+656	+483	+559
Nitrogen ..	N.S.	***	***	*	N.S.	**
N ₀ ..	1,060	1,725	981	1,015	746	653
N ₁ ..	+23	+339	+160	+95	+41	+109
N ₂ ..	—99	+475	+198	+206	+62	+184
Phosphate ..	**	N.S.	*	***	***	***
P ₀	893	1,902	1,033	996	649	594
P ₁	+198	+139	+91	+221	+196	+231
P ₂	+227	+134	+112	+136	+198	+239
Potash ..	N.S.	***	N.S.	N.S.	N.S.	N.S.
K ₀ ..	1,020	1,793	1,062	1,130	740	775
K ₁ ..	+16	+237	+57	—73	+74	—7
K ₂ ..	+34	+362	+58	+29	+48	—66
S.E. ..	±44	±52	±28	±57	±36	±34
Sig. Diff. 5 %	125	150	79	163	103	96
Sig. Diff. 1 %	167	200	105	218	137	129
Sig. Diff. 0.1 %	219	263	138	286	180	169

(2) *Sulphur Deficiency*.—The 1953 trials designed to ascertain (a) the relative contributions of sulphur and phosphate to the superphosphate affect and (b) to demark the sulphur deficient areas, were repeated in 1954 in a modified form. The modification was to increase the treatments from four to seven by including double rates of gypsum, triple phosphate and superphosphate, which were 77.4, 64.4 and 120 lbs. per acre respectively.

As in the previous year this experiment was to have been laid down at all stations. The experiments were not carried out at Ilorin and Daura due to either late arrival of the materials or the lack of a suitable site. The results from three stations namely Bauchi, Bida, and Zonkwa were considered crop failures and are not included in this report. The haulm and kernel yields for the various stations are presented in Tables 50 and 51.

The sulphur effect has shown up quite markedly on the foliage in past years at Kontagora, the plots receiving neither sulphur nor superphosphate being a much paler green in colour and giving a slightly less luxuriant growth, closely resembling nitrogen deficiency symptoms. These symptoms were again generally observed this year and especially at Kontagora, Daudawa, Kafinsoli and Yola, where the non-sulphur plots could be readily picked out in the field.

As was to be expected there was a general increase in haulm yield throughout the region for applications of either gypsum or superphosphate. There was of course considerable leaf drop before harvest, which no doubt accounts for only the two stations, Kafinsoli and Kontagora, showing significant increases in haulm yield due to gypsum, although five out of the nine stations gave significant increase for superphosphate application.

The sulphur effect on kernel yield, unexpectedly, does not follow the effect on the haulm yield. There are as many depressions in yield as there are increases and only one case of significance due to an increase of 169 lbs. (16%) at Kafinsoli. The phosphate effect, although following the general trend of past experiments, is of a much lower order and is significant at only three of the 10 stations.

The overall effects for both haulms and kernels are presented in Table 52. The four stations which showed marked foliar and significant haulm yield differences have been combined and are presented separately in Table 53. The latter table shows the same general trends as the overall table but the yield differences are of a much larger order.

TABLE 50.—PHOSPHORUS AND SULPHUR ON GROUNDNUTS
Kernel yields lb/acre all stations 1954

Stations Treatment	Gusau	Daudawa	Kano	Maigana	Yandev	Maiduguri	Yola	Kafinsoli	Koriagora	Samaru
	N.S.	*	N.S.	N.S.	N.S.	N.S.	N.S.	***	***	N.S.
Super 2	614	805	1,109	715	701	963	408	1,173	593	645
Super 1	457	845	1,135	727	757	1,133	548	1,233	511	600
Triple 2	538	854	1,022	827	864	1,178	612	1,114	536	729
Triple 1	518	700	1,100	684	799	1,180	581	1,097	415	754
Gypsum 2	442	693	1,050	658	717	1,133	481	1,173	349	544
Gypsum 1	366	596	1,079	642	774	977	405	1,173	341	524
Nil	435	595	1,064	703	738	1,078	446	1,004	337	555
S.E.	±68	±65	±61	±44	±71	±78	±59	±30	±31	±62
Sig. Diff. 5%	—	190	—	—	—	—	—	89	89	—
Sig. Diff. 1%	—	—	—	—	—	—	—	120	121	—
Sig. Diff. 0.1%	—	—	—	—	—	—	—	160	162	—

TABLE 51.—PHOSPHORUS AND SULPHUR ON GROUNDNUTS
Haulm yields lbs/acre dry hay all stations 1954

Stations			Gusau	Daudawa	Kano	Maigana	Yandev	Yola	Kafin-soli	Kon-tagora	Samaru
Treatment			Not Analysed	***	N.S.	N.S.	N.S.	***	***	***	**
Super 2	...	...	1,275	2,458	2,264	2,474	1,500	1,360	1,532	1,411	1,812
„ 1	...	...	1,259	2,096	2,364	2,570	2,371	1,160	1,478	1,277	1,570
Triple 2	...	...	1,432	1,902	2,068	2,790	1,443	968	1,234	981	1,845
„ 1	...	...	1,130	1,894	2,156	2,401	1,470	880	1,179	914	1,410
Gypsum 2	...	...	1,049	1,773	2,192	2,270	1,197	792	1,386	1,277	1,299
„ 1	...	...	1,134	1,652	2,208	2,760	1,362	768	1,424	1,156	1,369
Nil	...	...	1,029	1,467	2,040	2,180	1,287	744	1,077	766	1,346
S.E.	...	...		±131	±114	±120		±59	±64	±90	±103
Sig. Diff. 5%	...	—		382	—	—		172	188	264	301
Sig. Diff. 1%	...	—		518	—	—		233	254	358	409
Sig. Diff. 0.1%	...	—		690	—	—		312	338	479	—

(The haulm yield was not recorded at Maiduguri).

TABLE 52.—PHOSPHORUS AND SULPHUR TWO-WAY TABLES
LBS/ACRE
Haulms
Average of 9 stations

				P ⁰	P ¹	P ²	Mean of P ⁰ and P ¹
S ₀	...	...	...	0	+167	+304	84
S ₁	...	...	...	+211	+357		284
S ₂	...	...	...	+145		+492	
Mean of S ⁰ and S ¹			...	+106	+262		184

Main effect P¹—P⁰ = 156, S¹—S⁰ = 200

Kernels
Average of 10 stations

				P ⁰	P ¹	P ²	Mean of P ₀ and P ₁
S ₀	...	...	...	0	+18	+132	+9
S ₁	...	...	...	—8	+99		+46
S ₂	...	...	...	+29		+77	
Mean of S ⁰ and S ²			...	—4	+59		+55

Main effect P—P⁰ = 63,

S—S⁰ = 35

TABLE 53.—P AND S TWO-WAY TABLES—
DAUDAWA, YOLA, KAFINSOLI, KONTAGORA
LBS PER ACRE AVERAGE

					<i>Haulms</i>			
					P^0	P^1	P^2	Mean of P^0 and P^1
S_0	...	...	...	...	1014	1217	1271	1116
S_1	...	...	...	...	1250	1503		1377
S_2	...	...	...	...	1307		1690	
Mean of S^0 and S^1	...	...	...	...	1132	1360		1246
Main effect $P^1 - P^0 = 228$,							$S^1 - S^0 = 261$	
					<i>Kernels</i>			
					P^0	P^1	P^2	Mean of P^0 and P^1
S_0	...	...	...	...	596	698	779	647
S_2	...	...	...	...	629	784		707
S_1	...	...	...	...	672		744	
Mean of S^0 and S^1	...	...	...	...	613	741		677
Main effect $P^1 - P^0 = 128$,							$S^1 - S^0 = 60$.	

Note.—Although these trials are not fully balanced factorials, the relative two-way tables have been prepared to illustrate the results.

It is interesting to note from both sets of two-way tables, that the ratio of response P:S is 3:4 for haulms and 2:1 in kernels. An interpretation of this could be, that in Groundnuts, sulphur is a greater limiting factor in leaf development than phosphate but with kernel yield the position is reversed.

The results of these experiments over the past few years indicate that both the sulphur and the phosphate content of superphosphate contribute to the increases of haulms and kernels yields of the groundnut crop. The trials also indicate that the available sulphur in Northern Nigerian soils is marginal as regards the requirement of the groundnuts crop and that in certain areas the lack of available sulphur may become a limiting factor. The overall results indicate that the sulphur requirement of the groundnuts is met when superphosphate is used as the fertilising agent.

Residual effects from the single rate of application of gypsum, triple and superphosphate applied in 1954 were ascertained at seven sites. The results were not significant except at Daura and Yola, where the residual phosphate effect was significant ($P = 0.05$). The test crops were Millet at Daura and Guineacorn at Yola.

D.—EXPERIMENTS, MIDDLE BELT

(1) *Yams, Ilorin Province.*—The experiments, designed to ascertain the fertiliser requirements for yams, started in 1952, were continued in the

same form in 1954. The design was a factorial layout using three levels of sulphate of ammonia (nil, 60 and 120 lbs per acre) and levels two of superphosphate (nil and 60lbs.) making a total of six treatments. Two experiments were located in each of 3 village areas namely Ballah, Okeoyi and Paiye. In the latter village an additional experiment of the same design was laid down with later planted yams (March) to be compared with the effects on the normal early planted yams (November-December). The results from the individual experiments are presented in Table 54.

The results follow the trend of the 1953 yields which is a general highly significant increase for applications of sulphate of ammonia. There is a slight non-significant increase for applications of superphosphate. These results are further illustrated in the two-way tables presented in Table 55. Section (a) deals with the 1954 results, while section (b) shows the combined 1953 and 54 results, a total of 15 experiments. The 1952 results have not been included as the plot size (1/50 acre) was too small for a yam crop and the coefficient of variation in the experiments was too great. The tables indicate that the response to nitrogen is almost a straight line. The effect of phosphate alone tends to depress yields slightly; however, in presence of nitrogen there is a small but marked increase, which is greater with the heavier nitrogenous applications. The general yield in all localities was better in 1954 than in 1953 and likewise the difference due to fertiliser applications were greater, as seen in the comparison of the (a) and (b) sections of Table 55.

TABLE 54.—ILORIN YAM FERTILISER EFFECTS, 1954

Yields in lbs per acre tubers

	<i>Okeoyi</i>		<i>Ballah</i>		<i>Paiye</i>		
<i>Nitrogen</i>	**	***	*	***	**	**	**
Nil	4,509	4,579	6,937	9,823	5,257	6,496	4,635
60 lbs.	5,281	5,664	8,408	10,819	8,332	8,311	6,200
120 lbs.	6,466	7,172	9,055	14,403	8,790	9,933	7,273
S.E.	±336	±159	±495	±715	±602	±578	±246
Sig. Diff. 5 per cent ..	1,012	479	1,491	2,156	1,815	1,743	742
Sig. Diff. 1 per cent ..	1,399	662	—	2,982	2,510	2,411	1,026
Sig. Diff. 0.1 per cent ..	—	914	—	4,122	—	—	1,417
<i>Phosphate</i>	N.S.	*	N.S.	N.S.	N.S.	N.S.	N.S.
Nil	5,325	5,577	7,876	11,199	7,525	8,181	5,961
60 lbs.	5,512	6,034	8,391	12,165	7,344	8,315	6,111
S.E.	±274	±130	±404	±583	±492	±472	±201
Sig. Diff. 5 per cent ..	—	391	—	—	—	—	—
Sig. Diff. 1 per cent ..	—	540	—	—	—	—	—

TABLE 55

(a) YAM FERTILISER EFFECTS ALL SITES* 1954

	No	N1	N2	Mean
P ₀	6307	7574	8592	7611
P ₁	6227	8032	9621	7960
Mean	6267	7803	9287	—

(b) OVERALL 1953 AND 1954

P ₀	5716	6706	7561	6661
P ₁	5489	6966	7927	6794
Mean	5598	6836	7744	—

* Includes March planted Paiye yams.

There is little doubt that farmers in these localities can expect reasonable economic increases in the yield of yams for applications of up to 1cwt. of sulphate of ammonia per acre. The phosphate response requires further investigation before any recommendations can be made for its use.

In addition to the above mentioned formal trials, the Agricultural Officer, Ilorin put down seventeen observation trials on farmer's fields with the following treatments: (a) nil (b) 60 lbs. of sulphate of ammonia (c) 60 lbs. each of sulphate of ammonia and superphosphate and (d) 120 lbs. each of sulphate of ammonia and superphosphate. A number of the farmers, however, harvested their crops without informing the Agricultural Assistant in charge, with the result that the harvest data were obtained on only nine farms. The yield data for these trials is presented in Table 56

TABLE 56.—ILORIN FARM OBSERVATION TRIALS

Lbs yam tuber per acre

Area	No. of replications	Yield	Difference due to		
			N1	N1P1	N2P2
Afon	3	8870	+ 583	+ 793	+ 817
Omu Afon	2	6855	— 135	+ 365	+2295
Oke Odde	4	7600	+1928	+1523	+3068
Average	9	7875	+1004	+1005	+2117

The results of these observation trials confirm the nitrogen effect seen in the formal trials on yams and indicate that sulphate of ammonia can be economically applied to the yam crop in other parts of Ilorin Province.

(2) *Yams, Benue Province.*—An experiment with three replications of a 3² factorial design of N (nil, 1 and 2 cwt. sulphate of ammonia per acre), P (nil, 1 and 2 cwt. superphosphate) and K (nil, $\frac{1}{2}$ and 1 cwt. muriate of

potash) was laid down on the Tractor Unit Farm at M'Batie in Benue Province to ascertain the fertiliser requirement of the yam crop in the area. The yield summary showing main effects only is presented in Table 57.

TABLE 57.—M'BATIE T. U. F. YIELD EFFECTS

Lbs per acre yam tubers

<i>Fertiliser</i>	<i>Sulphate of Ammonia</i>		<i>Superphosphate</i>		<i>Muriate of Potash</i>	
<i>Levels</i>	***	<i>diff</i>	<i>N.S</i>	<i>diff</i>	<i>N.S</i>	<i>diff</i>
0	10180		14429		13925	
1	14107	+3927	13005	—1524	13005	—920
2	16029	+5849	12882	—1547	13386	—539
2—1		+1922				
Sig. Diff. 5% ..		1506				
Sig. Diff. 1% ..		2006				
Sig. Diff. 0.1% ..		2473				

Here, as in Ilorin, yams have responded to applications of sulphate of ammonia producing increments of a large order. The respective increments are 3927 (38.5%) and 5949 (57.4%) lbs. per acre for the one and two cwt. dressings. The second hundred weight of Sulphate of Ammonia produces a further increment of 1960 lbs. *i.e.* approximately 50% of the increase due to the first cwt. applied.

(3) *Early Maize Interplanted with Guineacorn, Ilorin Province.*—The experiments on the application of nitrogenous and phosphatic fertilisers to early maize, interplanted later with Guineacorn, were identical in design and rate of application to the yam experiments, and were sited in the same localities as part of the investigation on the requirements of the main food crops in Ilorin Province. The summary of yields, showing main effects only, is presented in Table 58.

TABLE 58.—MAIZE YIELD SUMMARY

Lbs dry grain per acre

Nitrogen	Okeoyi		Ballah		Paiye	
	A	B	A	B	A	B
	***	***	***	***	N.S.	*
N ₀	253	379	771	1470	922	756
N ₁	368	466	1066	1647	989	931
N ₂	460	586	1049	1919	958	980
S.E.	±88	±20	±52	±57	±40	±46
Sig. Diff. 5% ..	—54	—60	—	—172	—	—141
Sig. Diff. 1% ..	25	84	—	237	—	196
Sig. Diff. 0.1% ..	104	115	245	328	—	—
Phosphate ..	N.S.	N.S.	**	N.S.	**	*
P ₀	750	466	874	1682	873	824
P ₁	371	487	1051	1676	1040	953
S.E.	±15	±16	±35	±46	±33	±38
Sig. Diff. 5% ..	—	—	—	—	98	116
Sig. Diff. 1% ..	—	—	144	—	135	168
Sig. Diff. 0.1% ..	—	—	—	—	—	—

The 1954 results followed the trends of the previous years, which is a general significant response to nitrogen in all three areas and a significant response to phosphate only in the Paiye area. Two-way tables of Interaction based on the results over the past four years have been prepared and are presented in Table 59.

TABLE 59.—TWO-WAY INTERACTION TABLES

Average differences of Maize yields, 1951-54. Lbs dry per grain acre

Area			N ₀	N ₁	N ₂	Average Yield
(a) Ballah	P ₀		0	130	190	
	P ₁		38	200	320	582
	Differences		78	70	130	
(b) Okeoyi	P ₀		0	114	170	
	P ₁		—3	150	242	336
	Differences		—3	36	72	
(c) Paiye	P ₀		0	21	25	
	P ₁		88	157	187	607
	Differences		88	136	162	

- (a) Average of 10 experiments 1951-54.
- (b) Average of 6 experiments 1952-54, due to one crop failure in 1952 and all the 1951 experiments having germination affected by misplacement of sulphate of ammonia with the seed.
- (c) Average of 7 experiments due to misplacement of sulphate of ammonia with seed in 1951.

The results of the experiments over the four year period may be summarised as follows.—

(a) *Ballah*.—All applications of sulphate of ammonia resulted in yield increases with 7 out of the 10 single dressing rates ($\frac{1}{2}$ cwt. per acre) and 9 out of the 10 double dressing rates respectively being significant. With one exception the double dressings gave a considerably greater increase in yield than the single dressing. The average percentage increase for the single and double dressings is 24.9 and 40.5 respectively.

The phosphate response is much less marked, there being 2 significant depressions and 8 increases in yield of which six were significant. The overall effect is an increase of 79 (31.6%) lbs. per acre for a $\frac{1}{2}$ cwt. dressing of superphosphate.

(b) *Okeoyi*.—As at Ballah all applications of sulphate of ammonia produced increases in yield, only one of the single rates of application failing to reach significance. The double dressing in every case produced a greater increment, the average of which was 95 lbs. of dry grain per acre over that of the single rate. The respective percentage increases were 38.4 and 66.6 per acre for the single and double dressings.

The phosphate response was of a low order. In three out of the six experiments phosphate applications produced increments, only one of which was significant. The overall increase is 37 lbs. (11%) dry grain per acre.

(c) *Paiye*.—The nitrogen effect is considerably less marked in the Paiye area than in the other two areas. In 1952 all experiments produced a non significant decrease in yield for applications of sulphate of ammonia. In the following two years the effect was reversed with all applications producing increases which in three out of the four experiments were significant for both the single and double dressings.

The phosphate effect of Paiye was the most marked of the three areas producing an average increase of 121 lbs. (19.6%) of dry grain per acre. Although the 1951 results are not included in the yield summary due to misplacement of the nitrogen carrier, it must be recorded that all three experiments resulted in increased yields due to phosphate and that two of three results were significant.

(d) *Interaction*.—In the individual experiments there was little or no indication of significant interactions. However table 59, made up from the average differences in yield compared to the nil application, shows that a considerable interaction does exist. The magnitude of the responses

compared to the average yield per acre clearly indicates the value of applying a mixed dressing of sulphate of ammonia and superphosphate in all three areas.

On the basis of the overall results, a dressing of $\frac{3}{4}$ cwt. sulphate of ammonia and $\frac{1}{2}$ cwt. of superphosphate has been provisionally recommended for the three areas.

The average yields of intercropped Guineacorn through the maize receiving the fertiliser dressings for the six experiments in 1954 are presented in Table 60 as a two-way table.

TABLE 60.—GUINEA CORN i. p. t. MAIZE, 1954

	<i>Average Yields per acre dry grains</i>			
	<i>No</i>	<i>NI</i>	<i>N2</i>	<i>Mean</i>
P_0	500	505	495	500
P_1	547	539	564	550
Mean	524	522	530	525

There were no significant nitrogen effects in any of the six experiments and only two of the experiments produced significant increases for phosphate. Due to crop failures in a number of the earlier experiments, there are insufficient data to indicate a trend in the effects of the fertilisers applied.

(4) *Guineacorn interplanted through early Maize, Ilorin Province.*—The third group of experiments in connection with the nutrition of major food crops in Ilorin Province, was the application of fertiliser to Guineacorn which was interplanted through early maize. The layout, rates and design were identical to the previously described yam and maize trials. The summary of yields, giving the main effects for each experiment and the average interaction for each site is presented in Tables 61 and 62.

TABLE 61.—N AND P ON GUINEACORN

	<i>Okeoyi</i>		<i>Ballah</i>		<i>Paiye</i>	
	***	***	*	N.S.	N.S.	**
N_0	326	291	600	599	491	435
N_1	426	376	688	664	532	511
N_2	563	477	578	625	596	535
S.E.	±22	±18	±26	±21	±29	±16
Sig. Diff. 5%	77	53	28	—	—	48
Sig. Diff. 1%	106	75	—	—	—	66
Sig. Diff. 0.1%	147	104	—	—	—	—
	*	N.S.	N.S.	N.S.	***	***
P	404	366	600	620	419	407
P_1	472	396	645	639	660	580
S.E.	±21	±14	±21	±17	±24	±13
Sig. Diff. 5%	63	—	—	—	72	—
Sig. Diff. 1%	—	—	—	—	100	—
Sig. Diff. 0.1%	—	—	—	—	138	75

TABLE 62.—N AND P ON GUINEACORN (ILORIN)

Two-way Tables showing differences lbs acre dry grain

		No	NI	N2	Average Yield
Okeoyi	P ₀	0	67	198	410
	P ₁	22	141	248	
	Diff.	22	74	50	
Ballah	P ₀	0	64	—25	629
	P ₁	8	90	28	
	Diff.	8	26	4	
Paiye	P ₀	0	5	10	517
	P ₁	120	233	299	
	Diff.	120	228	289	

The results as given in the tables indicate that the guineacorn responses are similar in each area as the responses of the maize crop i.e. the major response at Okeoyi and Ballah is to the nitrogen carrier and at Paiye to the phosphate carrier. However in all cases the greatest increment is obtained with a mixed dressing of sulphate of ammonia and superphosphate.

Due to the number of crop failures in 1952 and 1953 with guineacorn in the experiments it is not possible to show the response over the 3-4 year period as has been done with the maize crop.

As would be expected there are no effects or trends on the maize crop when fertilisers are applied to the guineacorn crop in Ilorin Province. This is due not only to the late application of the fertiliser (within three weeks of the maize harvest) but also to the fact that the intercropping is in the form of alternate rows.

(5) *Soya Beans, Niger Province.*—The production of soya beans in the Kontagora area of Niger Province has been increasing during the past few years and a start was made in 1954 to ascertain the fertiliser requirements of the crop. A factorial experiment with six replications was laid down on the Groundnut farm with a combination of treatments using sulphate of ammonia and superphosphate. Details of the treatments and the yield summary is given in Table 63.

TABLE 63.—SOYA BEAN N AND P EXPERIMENT
Yields in lbs seed per acre

<i>Treatments</i>				<i>Yield</i>	<i>diff.</i>
<i>Sulphate of ammonia</i>				<i>N.S.</i>	
N ₀	Nil	...	...	677	
N ₁	56 lbs. per acre			703	+26
	S.E.	...	...	±22	
Superphosphate				...	***
P ₀	Nil	...	...	530	
P ₁	56 lbs. per acre			683	+153
P ₂	112 lbs. per acre			854	+324
	S.E.	...	...	±27	
Sig. Diff. 0.1%				148	

There was a highly significant response to use of superphosphate on the soya bean crop. Increased dressings of superphosphate produced proportionately greater increases in yield.

(6) *Time of application of N and P to Guineacorn.*—Two experiments were held down, one at Bida and the other at Ilorin, to ascertain the optimum time of application of both N and P to Guineacorn. The crop at Bida was a failure and at Ilorin no significant effects were obtained, although there was a trend in favour of application after planting for both types of fertiliser as shown in Table 64.

TABLE 64.—TIME OF APPLICATION OF N AND P TO GUINEACORN
Yields in lbs grain per acre

	<i>At Planting</i>	<i>2 leaf stage</i>	<i>4 leaf stage</i>
Mean N application	1041	1173	1116
Mean P application	1031	1162	1153

(7) *Badeggi Tractor Unit Farm, Fertility.*—The Badeggi Tractor Unit Farm had to be abandoned in 1953 due to extremely low yields. Observation trials were laid down to obtain the relative effects on the yield of guineacorn of, f.y.m. and mixtures of N, and P and K, wood ash and anthills alone and in combination with f.y.m. Although the final yields in all cases were far below average, certain indications were obtained. The addition of f.y.m. alone had little effect; although substantial increases were obtained from heavy dressings of a mixture of N, P and K, the greatest increase was obtained with f.y.m. and a heavy dressing of an N and P mixture. The

heavy dressings of N and P were at the rate of 2 cwt. per acre. It is apparent from these observations that the soil of the Tractor Unit Farm is thoroughly run down and extremely heavy dressings of fertiliser in addition to f.y.m. will be required if average yields are to be obtained.

E.—TRIALS ON FARMERS OWN FARMS, MIDDLE BELT

In order to ascertain the levels of nitrogenous and phosphatic fertilisers required to increase the yield of various crops under local farming conditions, and to cover areas at present not catered for by the Agricultural Stations, a series of trials was started in 1955 in Plateau and Benue Provinces. Trials have continued in the original areas and extension of the trials to new areas has gradually taken place. Eight to ten suitable sites are selected in each area and each site forms a single replication of a 3^2 N and P factorial layout using nil, $\frac{1}{2}$ cwt. and 1 cwt. of both sulphate of ammonia and superphosphate. The farmer follows his own system of cultivation, with the Department applying the fertilisers and supervising the harvest in order to obtain the record of yields. The results of these trials will be discussed by Province and crop.

(1) *Plateau Province, Guineacorn.*—(a) Andaha—Southern Division. Guineacorn responded with yield increases to the application of both sulphate of ammonia and superphosphate. As in 1953 there is no difference in the response to $\frac{1}{2}$ or 1 cwt. dressing of the nitrogen carrier. The phosphate response is only barely significant at the higher rate of application. The responses are of somewhat lower order than those in 1953. The yield summary is presented in Table 65.

TABLE 65.—ANDAHA FARMERS' TRIALS, GUINEACORN

	<i>Yields in lbs grain per acre</i>			
	<i>No</i>	<i>N1</i>	<i>N2</i>	<i>P Means*</i>
P_0	492	583	515	530
P_1	502	585	583	557
P_2	548	637	635	613
N Means*	514	602	584	566

Main effects; Sig. diff. 5% = 69 lbs.

(b) *Yelwa Lowlands Division.* There were significant increases in the yields of guineacorn for both the nitrogenous and phosphatic fertilisers. The increases were of a higher order than those at Andaha, and of the experiment in the preceding year, where only the phosphate response was significant though a trend was indicated for nitrogen. The yield summary is presented in Table 66.

TABLE 66.—YELWA FARMERS TRIALS GUINEACORN

Yields in lbs grain per acre

	No	N1	N2	P Means**
P ₀	522	741	605	623
P ₁	601	743	896	747
P ₂	652	816	883	784
N Means**	592	767	795	741

Main effects. Sig. Diff. 5% = 84
 Sig. Diff. 1% = 112
 Sig. Diff. 0.1% = 139

(c) Langtang—Pankshin Division. This experiment in 1954 was the first trial in the Langtang area. It suffered from heavy stem borer attack with resultant low yields, averaging 209 lbs of grain per acre. Although analysis shows a significant increase ($P = .05$) for applications of sulphate of ammonia, the experiment must be considered a failure.

(2) Plateau Province, Cotton, Jermai.—This was the 2nd year of cotton experiments in the area on farmers plots. A number of replications were harvested without an Agricultural Assistant being present to record yields. The recorded yields were low and no significant effects were obtained.

(3) Plateau Province, Groundnuts.—Jermai.—The results of the trial on Groundnut showed definite trends for increase in both kernel and haulm yields due to applications of both nitrogenous and phosphatic fertilisers. However due to the high coefficient of variation only the nitrogen effect was significant ($P = .05$) in the kernel yield although both factors were significant ($P = .01$) in the haulm yield. The yields of both kernels and haulms are given in Table 67.

TABLE 67.—JERMAI FARMERS' TRIALS, GROUNDNUTS

Yields in lbs kernels and dry hay per acre

Kernels						Haulms					
		No	N1	N2	P. Means			No	N1	N2	P. Means**
P 0	...	220	375	443	346	P 0		318	635	825	593
P 1	...	330	463	441	411	P 1		750	810	1,003	854
P 2	...	435	437	491	454	P 2		738	945	830	838
N. Means *		328	425	458	404	N. Means**		602	797	886	

Main effects. Sig. Diff. 5 per cent = 99 lbs
 5 per cent = 152
 1 per cent = 206 lbs

(4) Benue Province, Guineacorn.—Two sets of trials were laid down in the Province, one set around Yandev in Tiv Division, the other around Oturkpo in Idoma Division. However a number of farmers harvested their plots without informing the Agricultural Assistant in charge and consequently insufficient data were obtained for analysis.

F.—EXPERIMENTS, NORTHERN BELT

(1) *Placement of Superphosphate*.—In the 1954 Cropping Scheme Committee meetings there was some discussion on methods of placement of superphosphate for various crops, and in particular the possible mixing of seed and fertiliser before sowing. It was decided to conduct a number of observation trials, to ascertain the effects of mixing fertiliser and seed compared to the recommended placement of one inch away from the seed.

Three trials dealing with the effect on germination only, were conducted by the Chemistry section, on small observation plots at Samaru. Two field trials were also laid down, one at Samaru and the other at Kafinsoli. A summary of the results is presented in Table 69.

TABLE 68.—EFFECTS OF SUPERPHOSPHATE PLACEMENT

Percentage Germination

(a) *Samaru (Chemist)*.

(1) 1st Test.				
<i>Treatment</i>	<i>Miaze</i>	<i>G'nut</i>	<i>G'corn</i>	<i>Millet</i>
56 lbs Super with seed	57.1	80.1	50.0	7.2
5 lbs Super 1" away	96.4	95.7	89.3	78.6
(2) 2nd Test.				
56 lbs Super mixed with seed	0	41.4	0	0
56 lbs Super 1" away	0	63.9	92.9	0
(3) 3rd Test.	<i>On cotton alone</i>			
56 lbs Super applied:	(a) Nil	(b) contact	(c) mixed	(d) in hole
		with seed	with seed	
% Germination	86.5	91.0	95.6	86.5

(b) *Samaru (Agronomist)*

<i>Treatment</i>	<i>Guineacorn</i>		<i>Cotton</i>	
	<i>Yield</i>	<i>% Stand Count</i>	<i>Yield</i>	<i>% Stand Count</i>
Nil	444	95.6	463	100
56 lbs mixed with seed	484	75.6	406	86.7
28 lbs mixed with seed	565	86.7	494	100
112 lbs mixed with seed	605	55.6	534	96.7

(c) *Kafinsoli**Yields in lbs grain per acre*

<i>Treatment</i>	<i>Guineacorn</i>	<i>Millet</i>
5 lbs placed	992	1,239
14 lbs mixed with seed	653	997
28 lbs mixed with seed	726	1,162
56 lbs mixed with seed	629	678

The results of these observation trials clearly indicate that the recommended practice of placement 1" away from the seed is the best for food crops. In the case of cotton, however, the fertiliser can be safely applied in contact with the seed.

(2) *Time of Application of Superphosphate to G'corn.*—The results of the two experiments at Samaru and Maiduguri in 1953 indicated that later application of superphosphate, i.e., at the 4 leaf stage produced the greatest increments in the yield of guineacorn. The trials with applications (a) at planting (b) at 2 leaf stage and (c) at four leaf stage was repeated at both stations and identical trials were also laid down at Samaru, Daudawa and Zonkwa. The results of the trials, with the exception of Zonkwa where the crop was a failure, are presented in Table 69. The results at Samaru and Maiduguri are the reverse of the previous year, Daudawa follows the same pattern of early applications giving greater increments than the late applications. The Gusau results however follow the 1953 pattern in which the later applications were better.

TABLE 69.—TIME OF APPLICATION OF SUPERPHOSPHATE
TO GUINEACORN, 1954
Yields in lbs grain per acre

Station	G3 (54) Gusau	S12 (54) Samaru	U5 (54) Maiduguri	W5 (54) Daudawa
Control yield (Po)	600	294	1,430	1,264
Increase due to P	N.S.	***	*	*
(a) At Planting	+49	+535 +298 +21	+298 +207	+305 +27
(b) At 2 leaf stage	+72 +23	+514 +277	+337 +246 +39	+331 +53 +26
(c) At 4 leaf stage	+199 +150 +127	+237	+91	+278
S.E. as % of G.M.	21.13	17.85	17.60	14.45
Sig. Diff. 5% ...		123	294	224
Sig. Diff. 1% ...		169		
Sig. Diff. 0.1%...		169		

(3) *Time of Application of N and P to Cotton.*—Two experiments were planned to investigate the time of application of both N and P to cotton at each of three planting dates, i.e., early, recommended and late planting. The times of application were planting time, thinning time and first flowering. The experiment at Samaru had to be abandoned due to labour shortage. The other experiment at Daudawa gave some interesting results. The effect of P was highly significant producing an increase of 156 lbs (34.7%) of seed cotton per acre. The interaction P × times of application was also significant indicating that the earliest application, at time of planting, was superior to application either at thinning or flowering of the cotton crop. The interaction of time of application × dates of planting approached significance and indicates (a) in early plantings, time of application has little effect (b) at the recommended date of planting the earlier application either at

planting or thinning is much superior (c) in late plantings there is little difference due to time of application of fertilisers. In this experiment the effect of nitrogen was not significant. The relative two way tables are presented in Table 70.

TABLE 70. —TIMES OF APPLICATION OF SUPERPHOSPHATE TO COTTON

(a) *Planting Times × Application of Superphosphate*

<i>Treatments</i>				P^0	P^1
Planting Time	...	...	...	431	+243
Flowering Time	...	...	...	479	+87
Thinning Time	...	...	...	438	+139

(b) *Application Times × Dates of Planting*
Approaches 5% Significance

<i>Treatments</i>				<i>Early</i>	<i>Normal</i>	<i>Late Planting</i>
Planting Time Application	...	...	...	653	616	388
Flowering Time	„	...	...	—77	—10	—2
Thinning Time	„	...	...	+28	—129	—35

(4) *Cassava*.—An experiment on monocropping of cassava with annual applications of f.y.m., nitrogen and phosphate in the form of a 3^3 factorial layout was started in 1953 on the Kano Farm Centre. The 1954 crop has not been harvested as yet. The 1953 results showed a significant response only to applications of sulphate of ammonia. The yields were N_0 5410, N_1 7351 and N_2 8790 lbs per acre.

(5) *Fortified f.y.m.*—A repeat of the 1952 and 1953 trials comparing the use of superphosphate, f.y.m., fortified f.y.m. and f.y.m. plus superphosphate was laid down at Samaru with guineacorn as the test crop. The residual effects from the 1953 applications were taken using groundnuts as the test crop. The results are presented in Table 71.

TABLE 71.—FORTIFIED F.Y.M.

Yields in lbs grain, kernels and dry hay per acre

<i>Treatment</i>	<i>G'corn</i>	<i>Residual (53) Kernels</i>	<i>G'nuts Haulms</i>
	***	***	***
1. Nil	305	350	977
2. 3 tons/acre f.y.m.	1,268	527	1,290
3. 3 tons fortified f.y.m.	1,030	670	1,574
4. Superphosphate	782	491	1,249
5. 3 tons f.y.m. plus super	1,216	669	1,510
S.E.	±55	±30	±47
Sig. Diff. 5%	168	88	138
Sig. Diff. 1%	223	120	188
Sig. Diff. 0.1%	302	162	255

This year's trials do not follow past results. There is no difference between f.y.m. alone and f.y.m. plus superphosphate; both of these are significantly better than fortified f.y.m. which is significantly better than superphosphate; this, in turn, is significantly better than nil.

The residual trial which gives highly significant results follows the trend in the year of application; there is no difference between fortified f.y.m. and f.y.m. plus superphosphate, which are considerably better than both f.y.m. and superphosphate alone; the latter two considerably better than nil.

(6) *Compost versus Nitrogen and Phosphorus on G'corn.*—In the Kano area, the usual practice in their almost continuous farming system is to apply compost and sweepings to the land at approximately 1.5. to 2 tons per acre. It had been suggested that better use of the compost might be made by putting it over a greater acreage at a lower rate and augmenting it with applications of nitrogen and phosphate. A four plot trial was laid down on the Wudil Road N.A. farm, near Kano, as an observational trial. The yields were adversely affected by a June-July drought in the area: however, as was expected, compost plus N and P fertilisers were superior to compost or to fertiliser alone.

(7) *Residual effects.*—(a) Nitrogen and Phosphate Experiments. The 1953 N and P experiments at Daudawa and Yola were continued in 1954 to ascertain the residual effects of the fertilisers. There was a crop failure at Yola; at Daudawa, with cotton following cotton, there was no significant effects.

(b) Phosphate experiments. Five experiments at four centres were continued in order to test the residual effects from previous applications of phosphates. Two of the experiments had the phosphate applied in the previous year; the fertiliser had been applied three years previously in the other three experiments. There were no significant residual effects in any of the experiments although the majority still showed a slight increase in yield due to the original phosphate application.

(8) *Tobacco Experiments.*—Two experiments on Tobacco were laid down, one at Gusau as a dry season crop and the other at Maigana as the normal wet season crop. The yields from the dry season crop are not yet available. Due to theft, damping off, stem borer and misapplication of fertilisers, the Maigana results are not reliable.

(9) *Organic Fertilisers.*—A repeat trial of the 1953 experiment comparing Urea and groundnut cake as fertilisers, with sulphate of ammonia and superphosphate was a crop failure.

G.—MINOR ELEMENTS

Nutrient Deficiencies on Yola Farm.—The yields of crops from both the experimental and general cropping sections of the Departmental Farm at Yola have been most irregular. The reports over quite a period indicate:

A very variable response to nitrogenous and phosphatic fertilisers in the majority of field experiments.

A relatively luxuriant growth of crops on termite mounds compared to surrounding areas.

Outstanding signs of chlorosis in various crops on many parts of the farm.

In 1954 it was decided to carry out a number of trials designed to see if the peculiar behaviour of the crops there was due to trace element deficiencies. The investigation was divided into three sections.

(a) *Pot Tests at Samaru.*—These pot tests were designed to ascertain the cause of the reported chlorosis, using Yola soil, and various nutrient solutions.

(b) *Pot Tests at Yola.*—This series of pot tests was a comparison of growth of crops in Yola and Samaru soils under Yola climatic conditions.

(c) *Field Observation Trials at Yola.*—This set of trials, designed to ascertain the response of crops to trace element solutions both alone and in combination with heavy dressing of fertiliser, consisted of four field plots for each test crop.

The trials are discussed under the above headings and in the order in which they were carried out.

(a) *Pot Tests at Samaru using Yola soil.*—Trial No. 1—To ascertain if the symptoms were due to a difference in Water table. This trial consisted of four treatments, each carried out on the 0-6" and the 6"-12" horizons of Yola soil. The pots were arranged to have the water level maintained at the surface, 3, 6 and 9 inch levels. Two sets of this type of trial were used, one for groundnuts without fertilisers, and the other for maize with the equivalent of 1 cwt. of superphosphate per acre. The results of the trials are given in Table 72.

TABLE 72.—EFFECT OF WATER TABLE HEIGHT

Groundnuts—Final dry weight of plants in lbs

			0-6" Soil	6"-12" Soil	Totals
Water table at 9"	...	...	.059	.016	.069
Water table at 6"	...	...	.021	.012	.033
Water table at 3"	...	...	.013	.007	.020
Water table at 0"	...	...	.005	.008	.013

Maize—Height of Plants in inches

Water table at 9"	...	...	24	17	41"
Water table at 6"	...	...	34	28	62"
Water table at 3"	...	...	24	12	36"
Water table at 0"	...	...	6	4	10"

As was expected, the lower levels of the water table produced the better growth and weight of plant. In spite of the 1 cwt. dressing of superphosphate in the maize trial, there were still signs of phosphate deficiency. In

neither trial did any chlorosis occur that could be correlated with conditions at Yola.

Trial No. 2 Minor Nutrients.—This trial was more elaborate and consisted of thirty treatments. It was designed to see if the abnormal symptoms observed at Yola could be reproduced and if so could they be corrected by addition of major and/or trace nutrients. The experiment consisted of three main treatments of (a) nil, (b) 2 cwts. each of sulphate of ammonia and superphosphate, and (c) 1 cwt. of muriate of potash in addition to the sulphate of ammonia and superphosphate of treatment (b). Each of these main treatments had 10 sub-treatments which were nil, a complete trace element solution, and the trace element solution less, in turn, Calcium, Boron, Molybdenum, Zinc, Copper, Magnesium, Manganese and Sulphur. Tomato plants were used as the test crop and each treatment consisted of a single plant in a pot.

Regular observations were made and at the end of three months the plants were harvested and the dry weight recorded. Large increases were obtained from the applications of N and P which were apparently slightly decreased by the addition of K. There was absolutely no indication of yield difference due to the various trace element solutions in the absence of N and P. In the presence of N and P there was indication of response but it was of such a variable nature that no conclusions could be drawn. Other than a phosphate deficiency symptom (in spite of the 2 cwts. per acre dressing of superphosphate) no deficiency symptoms were observed.

(b) *Pot Tests at Yola.*—This trial was designed to compare the growth of tomatoes and maize in Samaru and Yola soils, the test on the latter soil being sub-divided into two sections one with and the other without the addition of f.y.m. These three main groups were sub-divided into ten for trace element solutions as in the Samaru trial.

The results for both crops indicated:

- (i) The plants in Yola soil without f.y.m. were poor and made very little growth. There was slightly better growth but the condition of the plants was still poor when f.y.m. had been added to the soil.
- (ii) Plants grown in Samaru soil were considerably better in all regards.
- (iii) There were no difference between the different trace element treated pots in any of the three main groups.

(c) *Field Observation Trials at Yola.*—A simple trial designed to ascertain in a field test if the abnormalities previously reported were due to the absence of trace elements in Yola soils. The trial on six different crops was made up of the following four treatments.

- (i) Nil.
- (ii) 2 cwt. sulphate of ammonia, 2 cwt. super, 1 cwt. of muriate of potash.
- (iii) Complete trace element solution.

(iv) Treatment (ii) plus Treatment (iii).

1. Citrus.—Treatments (ii), (iii) and (iv) must have been applied too close to the tree as severe scorching occurred. There were no results available from this test on this account.

2. Groundnuts.—Here again as in the citrus there was some scorching due to the trace element solution, which might be attributed to the fact that there was no rain for three weeks following the date of application. The yields are presented in Table 73 as lbs per acre.

TABLE 73

<i>Treatments</i>	<i>No. of healthy plants</i>	<i>No. of Rosetted plants</i>	<i>Kernel Yield</i>	<i>Haulm Yield</i>	<i>Haulm: ratio</i>
Nil.	109	60	390	800	2.05
NPK	144	41	399	2,240	5.61
T.E.	173	16	479	1,120	2.34
NPK + T.E.	177	0	626	1,360	2.17

The results indicate that rosette infection is correlated with trace element treatments. It could be assumed that plants were more susceptible to rosette attack where trace elements are lacking, but there is also the possibility that the observer in this case confused deficiency symptoms with rosette. In view of the yield differences and the fact that in the presence of trace elements the Haulm to Kernel ratio is nearer normal, there are some grounds for suspecting the lack of one or more trace elements may be contributory to the low yields in the Yola area.

3. Maize.—The maize in this trial was late planted and, in addition to drought effects, it suffered from scorching as did the previously mentioned crops. During the growing period severe phosphate deficiency symptoms were observed on the plots receiving no phosphate, the plots receiving fertilisers were far superior throughout the season. The harvest details are given in Table 74.

TABLE 74.—YOLA MAIZE TRACE ELEMENTS FIELD TRIAL

<i>Treatments</i>	<i>Final Stand</i>	<i>weight of Cobs (lbs)</i>	<i>weight of Stalks (lbs)</i>
1. Nil	70	4.94	8.5
2. N and P	68	11.31	36.5
3. T.E.	70	3.37	10.0
4. N and P + TE ...	58	9.31	28.5

The low stand count for treatment 4 precludes complete comparison. However the yield figures together with visual observations, indicate that low yields are probably due to low fertility and not to an absence of trace elements.

4. *Cotton*.—On account of a fertility trend in the field the results are of no practical value. Observations during the growing season indicated that cotton responded to the application of fertilisers, very greatly and within four weeks of application the plants so treated were twice the height of those in the nil plots.

5. *Pigeon pea*.—This crop was a failure due to the fertiliser dressing with a high nitrogen content, being placed too close to the plants which subsequently died.

6. *Tomatoes*.—This was the most successful of the field trials. The plots receiving the dressing of fertilisers were superior in every regard throughout the growing season; in addition the plots not receiving the dressing showed severe phosphate deficiency symptoms. The number and weight of fruit produced have been arranged in two-way tables in Table 75.

TABLE 75.—YOLA TOMATO FIELD TRIAL

Number of Fruits per acre

<i>Treatments</i>			<i>Nil</i>	<i>Trace Elements</i>	<i>Mean</i>
Nil	...	...	71,840	38,000	54,920
N and P	...	...	129,920	174,960	152,440
Mean	...	...	100,880	106,480	

Weight of Fruit per acre

<i>Treatments</i>			<i>Nil</i>	<i>Trace Elements</i>	<i>Mean</i>	<i>Wt. per fruit</i>
Nil	...	...	5,310	2,787	4,049	0.037
N and P	...	...	12,437	15,435	13,936	0.0920
Mean	...	...	8,874	9,111		
Wt. per fruit	...	...	0.0848	0.0808		

The effect of the dressing of nitrogenous and phosphatic fertilisers is particularly outstanding, producing not only a very large increase in the number of fruits and yield weight but also an increase in the weight of individual fruits. The addition of the trace element solution appeared to have a depressing effect in the absence of N and P, but in their presence produced an increase in number and weight of fruit.

Summary.—The results of the various trials indicate a severe nutrient deficiency (probably with P as major factor) in the Yola soils, which accounts for the poor growth of crops in the area. Trace Elements alone are ineffective, but in presence of adequate N and P and exert a marked beneficial effect.

H.—MISCELLANEOUS

(1) *Soil surveys*.—The Section devoted more time to soil surveys than in any previous year. The soil surveys during the year were all of a detailed nature. The field work was completed during the dry season on three

Government Farms (a) Zonkwa (500 acres) (b) Osara (500 acres) and Northern Research Station, Samaru (2,000 acres). Interim reports complete with colour soil maps have been completed for the Zonkwa and Osara Surveys, and for the Lowland Experimental Station, the survey of which was carried out in the 1953-54 dry season. The report on the N.R.S. survey will be completed in the coming year.

(2) *Irrigation water*.—Samples of irrigation water from two sources, lake and well water, for the Rima fadama in Sokoto Province, where a large dry season farming scheme is envisaged, have been analysed at regular intervals in co-operation with the Government Chemist, Kaduna. A deposition of salt has been noticed in the fadama in the past and the nature of the salts and the amount of deposition is being studied in relation to the effect on various crops. There is a considerable difference in the sulphate content of the two irrigation waters but its effect on the crops cannot be ascertained until the harvest records are available.

(3) *Grain Storage*.—When the Argentine grain tank was being filled, a total of nine lead capillary tubes were laid in the grain, so that gas samples could be taken when desired from representative areas of the tank. Considerable difficulty was encountered in the first instance in obtaining a satisfactory sample of gas for analysis. This difficulty was eventually overcome by soldering large caliber hypodermic syringe needles to the ends of the capillary tubing and regular sampling followed. Although it was originally intended to analyze the gas from the tank for both Oxygen and Carbon-dioxide contents, it was decided at a later date to dispense with the Oxygen analysis. There was a very slow increase in CO₂ content in the early stages, but a fairly rapid build up occurred later, with the CO₂ content rising to 12 per cent and remaining more or less constant at this point until the tank was opened on 17th March, 1955 for examination.

PART V.—COTTON BREEDING AND SELECTION

By H. E. King and D. A. Lawes

INTRODUCTORY

Work for the season continued along established lines. Selection and testing of material derived from Samaru 26C and other Allen stocks took first place. Some introduced types were included in tests and some hybridization was done.

Trials of seed disinfection to control bacterial blight were continued together with other field experiments run in conjunction with the Agronomist.

Advice and assistance with arrangements for seed distribution and other aspects of the organisation of the commercial crop were given on an increasing scale. The seed multiplication scheme at Gombe was maintained and further developed. A tour was made through the "Middle Belt" to study the general and plant breeding prospects for cotton there.

The acreage under cotton breeding and seed multiplication plots at Samaru was the largest ever totalling to 34 acres. Yields were extremely variable but in the better treated plots generally good and in some fields previous record levels were easily passed.

In the replicated experiments the usual and apparently unavoidable high standard errors were encountered in spite of some changes in shape of plot and design of experiment.

The season in general was a good one for cotton. Waterlogging during August held back growth and fruiting but recovery later was good except in fields of low fertility. Picking continued rather late, both at Samaru and in the District Variety Tests at outstations, delaying the completion of ginning and laboratory work and the analysis and digestion of the results.

BREEDING WORK

Replicated and unreplicated progeny rows and reselection plots of a wide range of types were grown. These included strains from Uganda of high lint quality and reselections of Albar 51-a type derived from Nigerian Allen of high resistance to bacterial blight (*Xanthomonas malvacearum*). Many promising single plant selections were brought in for laboratory examination but results of this work are not yet complete.

A replicated yield test of 49 "Small Bults" (the next stage beyond progeny rows) gave a wide range in yields and other measurable characters. Several types from this will go forward to larger scale tests in the coming season including Albar 51/645. None of the Uganda BP 52 lines in this test appeared promising for growth in Nigeria.

A "Strains Test" containing 21 promising strains from previous small bulks trials gave highly significant yield differences and confirmed that there is still a considerable measure of variability in yield and laboratory characters amongst current substrains of Allen origin.

A programme of hybridization was commenced, designed to combine the good characters of local strains with desirable features of a number of introduced types. This is a long term project which will not begin to yield results for some seasons but will become of increasing importance as the present programme of straight reselection from Allen stocks approaches the point where further advances are limited by decreasing genetic variability.

DISTRICT VARIETY TESTS

The usual series of district tests was carried out by arrangement with the Agronomist and the departmental staff at the various experimental stations throughout the cotton growing areas. Twelve experiments, each an 8 by 8 Latin Square, were grown with the same strains included throughout. When these tests were commenced in 1950-51 it was hoped that the results at the individual stations would be of sufficient accuracy to reveal the presence or absence of interactions between strains and localities. This has not proved to be the case; the relative yields of the strains are widely different

from the different stations but the standard errors are almost without exception far too high for there to be any suggestion of real locality effects. The current season's results were in this respect worse than usual, coefficients of variation ranged from 10.5 per cent to 33.3 per cent with all but two over 18 per cent. In these circumstances it is a matter of congratulation that any results of value have emerged.

The mean overall results, omitting only the worst site (Maigana), are in fact satisfactory and place the eight strains in an order of merit which is in fair accord with expectation on their previous history. Moreover, the comparisons remain much the same if a simple average is replaced by a mean calculated from the yields of different experiments weighted in accordance with their accuracy.

The seed-cotton yields of the separate experiments are summarised in Table 76 and the combined results, including lint yields, are given in Table 77. It will be seen from these that, on average, each of the reselections from Samaru 26C has given some advance in lint yield over the control bulk stock. This bulk is the strain issued as "New Nucleus Stock" three seasons ago and as such was itself an advance on previous stocks (see 1953-54 report).

In contrast with last season the range in control yield from locality to locality was extremely wide. This does not necessarily indicate any such range in the general crop yield of the localities but is a reflection of the state of fertility of the particular fields used for the experiments. At Samaru for instance, both the tests were grown (deliberately) without manure; an adjacent manured field gave a yield of over 1,100 lbs. of Seed Cotton per acre.

The yield of the Maiduguri experiment is again remarkable (last season it was 797 lbs.). This locality also provides an example of the unreliability of the strain comparisons in any one year at one site. In 1953-54 the strain 479-25 gave only 94 per cent of the seed cotton yield of the control; this season 479-25 B.C.P. gave 128 per cent. There is no reason to suppose that more than a fraction of this "improvement" is due to the substitution of a mass reselection (497-25 B.C.P.) for the older stock (479-25). At Kontagora, by way of contrast, the 479-25 line has now given, in three successive seasons, 121 per cent, 116 per cent and 122 per cent of control 26C. These Kontagora tests were all under conditions giving low general yields.

The main outcome of these District Tests is the confirmation that the 479-25 line fully merits immediate acceptance as a successor to 26C. It has shown itself very substantially higher yielding in terms of seed-cotton and now, as represented by 479-25 B.C.P. and the two new substrains 479-25-44 and 479-25-97, it can retain much of this advantage when yields are given as ginned lint.

Its chief competitor over the last three seasons, strain 49160-23, has done almost equally well this season but lost ground last season and must be regarded as less reliable, though most promising material for further selection work. Like 479-25 it is notably earlier cropping and a clear improvement over 26C in spinning quality.

Of the remaining types 26I/25 is worthy of note as having given the highest lint yield of all. It is a new-comer to these tests and must repeat this performance and show evidence of lint quality before going further. The original 26I strain was of doubtful quality.

TABLE 76.—DISTRICT VARIETY TESTS SEASON, 1954-55

Seed—Cotton Yields from Eleven Experiments

Locality with yield of Control Type in lbs. per acre (in brackets)	Yield of the other Seven Strains expressed as percentage of that of the Control Type (Pure Stock 26C ex-stage D)							S.E.
	New Issue	479-25 B.C.P.	479-25-44	479-25-97	49160-23 B.C.P.	4736-112	26I.25	
Samaru Timely (374) ...	95	92	96	96	99	80	94	6.1
Samaru delayed (305) ...	89	96	82	100	113	91	108	6.9
Daudawa Timely (232)...	119	97	138	108	135	114	132	12.1
Daudawa delayed (133)...	114	153	100	128	140	87	129	13.5
Gombe Timely (381) ...	117	118	113	118	117	116	119	8.0
Gombe delayed (350) ...	109	112	104	107	112	113	122	4.1
Gusau (505) ...	102	105	108	99	102	99	105	3.8
Kano (138) ...	97	130	128	111	97	141	107	7.7
Maiduguri (857) ...	98	128	97	112	111	103	97	8.7
Kontagora (124) ...	103	122	114	109	114	90	107	7.1
Zonkwa (245) ...	116	111	94	79	97	93	94	10.7

TABLE 77.—DISTRICT VARIETY TESTS SEASON, 1954-55

Combined Results from Eleven Experiments

Strain	Seed-Cotton Yield in lbs. per acre and as percent of Control Type		Ginning %	Lint Yield	Lint Length
	(a)	(b)			
Pure Stock 26C ex Daudawa Stage D	333 (100)	228 (100)	34.9	79.6 (100)	32.2
New Issue of 26C ex Samaru	346 (104)	235 (103)	34.7	81.5 (102)	32.6
26C/479-25 B.C.P.	378 (114)	258 (113)	33.4	86.2 (108)	33.0
26C/479-25-44	346 (104)	244 (107)	35.4	86.4 (108)	33.5
26C/479-25-97	352 (106)	240 (106)	35.1	84.3 (106)	33.2
26C/49160-23 B.C.P.	369 (111)	250 (110)	34.6	86.6 (109)	33.2
26C/4736-112	339 (102)	236 (104)	36.4	85.7 (108)	32.3
26I/25	356 (107)	251 (110)	35.6	89.3 (112)	32.7

- (a) Simple mean. (b) Weighted mean; weights proportional to reciprocal of error mean square. (c) Simple mean.
 (d) Calculated from weighted Seed Cotton yields.
 (e) Millimetres, Bailey Halo.

LINT QUALITY

Results of spinning tests on the more important strains mentioned above are available for previous seasons; samples from the 1954-55 crop have not yet been spun. The data summarised below are therefore extracted from reports for the seasons 1950-51 to 1953-54. Individual tests on small samples can give widely divergent results; the means of accumulated data from several seasons and various localities give a sounder comparison.

There have been, in all, 19 tests of material from strain 479-25 in comparison with 26C. These include samples from district variety tests at Gusau, Kano, Maiduguri, Gombe and Kontagora as well as Samaru and Daudawa experiments. The mean values for various characters are as follows—

	479-25	26C
Effective Length (32nd inch)	36.7	36.5
Maturity Ratio	0.807	0.803
Standard Hair weight (10 ⁻⁵ mgm per cm)	201	218
Lea count by Strength product at 40's, corrected T.F. 3.75)	2022	1881
Yarn appearance class (4 = Fair, 5 = Moderate)	4.65	4.61

In length and maturity ratio there is no appreciable difference but 479-25 has a distinctly lower hair weight and may therefore be claimed to be a finer cotton. This is reflected in the lea count by strength figures which show 479-25 to give yarn about 7 per cent stronger. This greater fineness and strength are obtained without loss of yarn appearance; the lower hair weight is due to intrinsic fineness and not immaturity.

Tests on the rival strain 49160-23 have given similar figures but over a less adequate number of samples. In view of its relatively poorer yields in 1953-54 fewer samples were sent although one early test of this selection suggested it was the better with yarn strength 18 per cent above 26C.

The 479-25 substrains 44 and 97 have been included in three sets of samples with mean results as follows.—

	479-25-44	479-25-97	26C
Effective length	38	37	37
Maturity Ratio	0.784	0.783	0.798
Standard Hair Weight	213	209	218
C by S Product	2085	2180	2032
Yarn Appearance	3.7	3.0	3.3
32 Fairly good, 4 Fair			

Both these substrains are somewhat finer than 26C; 479-25-97 has given a significantly higher yarn strength. This selection is probably not appreciably inferior to 479-25 but 479-25-44 (which has a higher ginning percentage) is not quite so fine. Further samples of these are now being prepared for tests but in the meantime it seems reasonable to conclude that neither is widely different from 479-25 itself.

SEED MULTIPLICATION

The usual series of small plots, containing all the strains appearing elsewhere in replicated tests were grown for seed production and gave satisfactory yields. Included with these were plots of "Mai Inchi Allen" and "Samaru 26C Botanists Stock" (in store since 1950). Selfed seed of both these was obtained for continued storage and future reference.

Larger plots were grown of the most promising strains. In the case of 479-25 B.C.P. it was found possible to sow an area of 5.8 acres using acid treated, Agrosan dressed seed at the rate of 3.6 lbs. per acre (equivalent to about 4.1 lbs. per acre of "raw" seed). Planted on the 29th of June and given superphosphate at 100 lbs. and sulphate of ammonia at 65 lbs. per acre by placement 16 days later, this crop gave a final yield of 1,150 lbs. per acre (700 lbs. of this being produced before Christmas).

The cost of growing and picking this crop (labour, mechanical precultivation and fertilisers) has been calculated as £15 15s 0d per acre. The yield, at 80 per cent grade 1 and 20 per cent grade 3, equals £27 16s 0d per acre. This most satisfactory yield (judged in relation to the general level of yields in Nigeria) suggests very strongly that this strain can maintain in bulk growth its good showing in the small plots of the replicated yield trials.

As a result of devoting so large an area to this one strain, and obtaining so high a yield per acre, the seed produced, augmented by some from its two substrains, should prove sufficient to supply Stage C of the Daudawa Multiplication Scheme, by-passing the 20 acre stage B. This step, if successful, will cut down by one season the period required to build up sufficient seed to plant the whole N. Nigerian crop. Taking the gain in yield from the change over to this strain as 8 per cent the financial gain from saving one season in this way can be put at about £800,000 at present prices and level of production.

Plots of the substrains 470-25-44 and 479-25-97 also gave good yields and produce from these was blended with that of 479-25-B.C.P. in the following proportions—

26C/479-25 B.C.P.	4,800 lbs. (=60%)
26C/479-25-44	1,600 lbs. (=20%)
26C/479-25-97	1,600 lbs. (=20%)
Total	<u>8,000</u>

Ginned at the Zaria ginnery this gave a ginning percentage of over 35.6 per cent and yielded 7 full size bales of ginned lint. The willing co-operation of the Manager, British Cotton Growing Association in this matter is most gratefully acknowledged.

CONTROL OF BACTERIAL BLIGHT BY SEED DISINFECTION

Following last season's work by Mr R. L. Burgess of Plant Protection Ltd., a trial of Agrosan G.N. 5 was carried out. For this a bulk of Samaru 26C seed was made by mixing samples from six ginneries to increase the likelihood of seed infection being present without having recourse to a selection not representative of the commercial crop.

Part of this seed was retained "raw" (i.e. fuzzy as it comes from the saw gin) part was machine delinted (twice through the machine) and part thoroughly treated with sulphuric acid.

A portion of each of these classes was dressed with Agrosan G.N. 5 and part left undressed giving six "treatments" for a 6 by 6 Latin Square design in 36 plots of 1/28th acre.

Planting date was 6th July and normal cultural methods were followed at a standard below the best experimental farm practice in ridging and weeding. Adequate care was taken however to plant exactly six seeds per hole for each class of seed.

The many detailed observations made during the season provided a mass of data. A selection of these is set out in the series of tables following. It is clear that the treatments had a marked effect on early growth and health. Both acid treatment and Agrosan dressing, applied separately, resulted in higher stand figures. One however is not merely a substitute for the other; when both treatments are applied to the same seed an added improvement results. They are evidently different in their mode of action with acid treatment the more potent in improving stands and strength of early growth.

With either, the improvement in the appearance of the seedlings was statistically significant and quite marked. In combination they produced seedlings very conspicuously larger than those from raw seed. This effect was obvious well before the time of appearance of the first typical symptoms of bacterial blight on seedlings from untreated seed.

In preventing the appearance of bacterial blight Agrosan was beyond question more effective though acid treatment did definitely reduce infection. The action of Agrosan was much the same on both raw and machine delinted seed. It gave similar figures with acid treated seed, the removal of the fuzz and prior partial sterilisation by the acid giving no improvement over the straight disinfection of raw seed by Agrosan alone.

The outstanding differences between treatments shown by the early counts of infected stands were progressively reduced over the period from 30th to 79th day. This can be attributed with confidence to the spread of

the disease from the plants which first showed it. By the 79th day the range in degree of infection had been very greatly reduced and the lowest percentage (in Table 82) was 46%. Further spread took place after this date.

The visible damage resulting from this spread was not great. The symptoms were mainly angular leaf spot and vein blight; boll lesions were rare. It was expected therefore that the plots which became infected late might show an advantage in yield over those from untreated seed at least in the early pickings. This was not so; the figures of Tables 83 and 84 show no differences in favour of Agrosan seed dressing.

In comparing these results with those obtained in 1953-54 it must be remembered that the design, the seed, the growth and the level of yields differed. In the current season's experiment the two treatments, "raw" undressed and machine delinted undressed, together made up a third of the total area. In the 1953-54 experiment, which gave an increase following seed disinfection, only 1/15th of the area was planted with undressed seed.

The seed used in 1953-54 was from a plot conspicuously attacked by bacterial blight and of a substrain suspected of more than normal susceptibility. It was chosen to give conditions under which Mr Burgess could compare a range of Plant Protection products for effectiveness in destroying seed borne infection. The higher susceptibility of this substrain has since been confirmed by tests at Namulonge.

The effect of bacterial blight on plant development and yield together with the effect of insect damage is further discussed in the section of Cotton Entomology pages 86 and 87.

TABLE 78.—COTTON SEED DISINFECTION EXPERIMENT

Stands with plant (or plants) present as per cent of stands sown

<i>State of Seed</i>	<i>Raw</i>	<i>M.D.</i>	<i>A.T.</i>	<i>Means</i>
Undressed	90	88	93	91
	80	76	89	81
Dressed with Agrosan	95	95	97	96
	84	87	90	87
Means	92	91	95	
	82	81	89	

Raw = ordinary saw ginned seed.

M.D. = machine delinted (twice run)

A.T. = Acid treated.

Upper figure is count 15 days after sowing.

Lower figure is count at end of season.

TABLE 79.—ESTIMATED TOTAL POPULATION OF SEEDLINGS AT THINNING AS PERCENTAGE OF VIABLE SEEDS SOWN

	<i>Raw</i>	<i>M.D.</i>	<i>A.T.</i>	<i>Means</i>
Undressed	51	47	65	54
Dressed	61	61	70	64
	56	54	68	

The germination percentage of the acid treated seed was 89.5%. Six seeds were sown per stand throughout. Stands were thinned to 2 plants and thinnings counted 30 days from planting.

TABLE 80.—STRENGTH OF SEEDLING GROWTH UP TO 22ND DAY
(*Mean scores awarded at days 7, 11, 15 and 22*)

	<i>Raw</i>	<i>M.D.</i>	<i>A.T.</i>	<i>Means</i>
Undressed	3.0	3.1	4.9	3.6
Dressed	3.3	4.0	5.3	4.2
	3.1	3.6	5.1	

Scored from 1 to 7 at each date with 3 = Rather weak, 4 = Moderate 5 = Rather strong growth. Differences between treatments were very highly significant. S.E. for mean score of individual treatments 0.16, for dressed and undressed 0.09 and for Raw, M.D. at A.T. means 0.11.

TABLE 81.—EARLY COUNTS OF STANDS SHOWING TYPICAL
Bacterial Blight Symptoms

	<i>Raw</i>	<i>M.D.</i>	<i>A.T.</i>	<i>Totals</i>
Undressed	49	35	6	90
	383	394	79	856
Dressed	0	0	0	0
	4	17	4	25
Totals	49	35	6	
	387	411	83	

Upper figure is count at 30 days from sowing. Lower figure is count at 52 days from sowing. In each case the figure is the number of stands showing some infection out of 1,700 to 1,900 stands examined. The highest figure (394) represents 25% of total stands.

TABLE 82.—LATER PERCENTAGES OF STANDS WITH BACTERIAL BLIGHT

	<i>Raw</i>	<i>M.D.</i>	<i>A.T.</i>	<i>Means</i>
Undressed	69	67	33	55
	84	85	59	75
Dressed	22	23	22	22
	47	46	50	47
Means	45	43	28	
	64	64	54	

The upper figure is percentage of stands showing symptoms at 65 days.
Lower figure is percentage at 79 days from planting.

TABLE 83.—YIELDS AT FIRST PICKING
Pounds of Seed Cotton per acre

	<i>Raw</i>	<i>M.D.</i>	<i>A.T.</i>	<i>Means</i>
Undressed	127	127	146	133
Dressed	111	130	125	122
Means	119 (100%)	128 (108%)	136 (114%)	

S.E. for individual treatment yields 6.9

S.E. for dressed and undressed means 4.0

S.E. for Raw, M.D. and A.T. means 4.9 (=4.1%)

Means Square for State of Seed (whether Raw, M.D. or A.T.)
suggested a treatment effect. Differences are in expected direction.

TABLE 84.—TOTAL YIELDS, LBS SEED COTTON PER ACRE

	<i>Raw</i>	<i>M.D.</i>	<i>A.T.</i>	<i>Means</i>
Undressed	511	502	501	550
Dressed	466	505	491	488
Means	488 (100%)	505 (103%)	496 (102%)	

S.E. for individual treatments 20.3

S.E. for dressed and undressed means 11.7

S.E. for Raw, M.D. and A.T. means 14.3 (2.9%)

No indication of any treatment effects.

AGRONOMIC EXPERIMENTS ON COTTON

The series of experiments designed to study the interactions of planting date, fertility level and spacing was continued. As a result of three seasons yields it has been possible to reach the conclusion that spacing, at least at Samaru and Daudawa, is unimportant. Variation from 9"x36" to 27"x36" (i.e., from 2.25 square feet per stand to 6.75 square feet per stand) has on average no appreciable effect on yield at any date of planting or level of fertility within the wide range tested. Kontagora yields for the current season, which show some spacing effects, are quoted on page 85; these are being followed up.

The spacings most generally employed throughout the main cotton growing areas of the Northern Region fall within these limits. The average probably approximates to the mid point of the range but with local tendencies to greater distances. Such local variations, if not in fact soundly based, are probably harmless.

Since however the widest spacing gives almost the same yield per unit area of land as does the closest it is almost three times as efficient in utilisation of seed. Wider spacing also enables the planting to be done more quickly. Any guidance on spacing which is given to the cultivator should therefore be towards wider spacing unless there are strong local indications to the contrary.

The other deductions from these experiments are less clear cut. Nothing in this season's results calls for any major modification of the views recorded last season on optimum planting date over the areas covered. The full results, however, need further study and the addition of data from some supplementary experiments before a final summing up can be presented. There is some indication of interaction of fertility level with planting date to be followed up. This applies only to the period mid June to mid July; the conclusion that manuring will not compensate for delay in planting after mid July still holds unchanged. This season's figures fully confirm the opinion that early July planting should be extended to the Kontagora area in spite of contrary views held in that area.

PART VI.—COTTON ENTOMOLOGY

By M. A. Choyce and M. G. Emsley

INTRODUCTION

Observations on the most important pests of cotton taken at various stations throughout the season show that populations were on the whole less than reported last year. The more southerly cotton-growing areas again suffered the heaviest losses, both in quantity and quality of cotton produced.

Details of the emergence of moths of the Red Bollworm from long-term pupae over five years have been summarised, and the latest results confirm the view expressed last year that emergence may sometimes be continuous from June to November.

Trials at Samaru and Daudawa again failed to show significant increases in yield following the use of insecticides. At Kontagora, where pests cause severe damage to cotton, large increases in yield followed the applications of a series of spray treatments. Though these increases were uneconomic, further trials in this area will probably yield valuable information.

Losses due to insects and disease at Daudawa and Samaru are provisionally estimated at about 25 per cent of the potential yield; in addition, between 12 and 15 per cent of the crop which can be picked is damaged.

Although a Close Season is more extensively recognised as an essential part of the cotton-growing system, its application is still far from complete. Vigorous and persistent action by all the authorities concerned is still required, particularly in view of the increasing acreage being sown with cotton.

A separate report has been submitted on conditions in the Riverain Provinces; the observations in this report refer only to the main cotton growing areas of Northern Nigeria.

INSECT PESTS

(1) *Diparopsis watersi*, (Roth)—Red Bollworm. Red bollworm populations at all recording stations were lower than those recorded last year. The highest incidence again occurred at Kontagora and Gombe, where peak populations of 6,300 and 4,700 larvae per acre respectively were found during early November. Very few bollworms were found at Samaru, and peaks of between one and two thousand per acre were counted at Gusau and Daudawa.

(2) *Biology of the Red Bollworm*.—The emergence of moths from pupae set in cages simulating natural conditions has been studied for a further year, and the results for the years 1948-55 are shown in Figure I

A full description of the methods used and an account of the work carried out in 1948-50 has been published by Geering, Q.A. and Baillie, A.F.H. (Bull. Ent. Res. 45, Pt. 4 pp. 661-681, 2 pls., 20 refs., 1954). The suggestion made in the Annual Report for 1953-54 that emergence might in some years be continuous is confirmed by the data from Samaru and Gombe for 1953-54. The conclusion of Geering and Baillie that emergence is discontinuous and confined to June-July and October must therefore be modified. Though the overall results indicate that the number of moths emerging during these months is usually higher than during the intervening period, this tendency was less marked at Samaru and Gombe for pupae set during the 1953-54 season and emerging during the last season.

It has been confirmed in all the observations that pupae set early in the season (before November) are of mainly the short term type, with a pupal life of about three weeks; pupae set after November emerge as moths during the following season. The date at which 50% of the settings give short term and 50% long term pupae falls in all cases during the first or second week of November.

Parasitism by flies of the genus *Carcelia* over the five years at Samaru never exceeded 30% for the short term emergences, and 24% for the long term emergences, the averages being 17% and 9% respectively. The emergence of the parasite follows that of the moths very closely, even through diapause to the following season.

(3) *Platyedra gossypiella*, Saund.—Pink Bollworm. The incidence of pink bollworm in the main cotton growing areas continued at a low level. As in previous seasons, the infestation in Adamawa Province was heavier than elsewhere. Table 85 gives the number of larvae from 1,000 split bolls, for all pickings combined, at several stations.

TABLE 85.—PINK BOLLWORM: NUMBER OF LARVAE PER 1,000 SPLIT BOLLS

<i>Standard Plots:</i>		<i>Peasant Farms in Adamawa Province: Numan Division</i>	
Samaru	7	Guyuk	141
Daudawa	5	Guyuk	145
Kontagora	18	Bobbini	80
Gombe	17	Shellen	115
Gusau	27	Shellen	117
		Numan	167

<i>Peasant Farms:</i>		<i>Northern Adamawa:</i>	
Gusau	12	Gurde	25
Gusau	44	Mubi	62
Gusau	48	Mirinyi	60
Gusau	32	Uba	29

The results of an examination of samples of seed cotton from 32 selected markets are given in Table 86.

TABLE 86.—PINK BOLLWORM. LARVAL COUNTS IN SEED COTTON SAMPLES

<i>Grade of Seed Cotton</i>	<i>No. of 1 lb. Samples</i>	<i>Larvae inside seed</i>		<i>Larvae outside seed</i>	
		<i>Living</i>	<i>Dead</i>	<i>Living</i>	<i>Dead</i>
I	33	15	14	2	6
II	41	49	73	1	24
III	39	28	37	7	28
Totals	113	92	124	10	58

The figures for Grade II include a sample from Mayo Belwa (Gombe Ginnery area) containing 11 living and 25 dead larvae, and a sample for Shinkafe (Mai-Inchi Ginnery area) containing 17 living and 13 dead larvae. Though there is a tendency for the lower grades of seed cotton to be more heavily infested, the absence of any striking differences is an indication of the relative unimportance of this bollworm in most areas.

(4) *Other Bollworms*.—Spiny bollworms were less common than last year, and populations were generally lower than those reported for Red Bollworm. Larvae of the False Codling Moth and American Bollworm were found infrequently, though the latter was more common at Kontagora and in the more southerly cotton growing areas.

(5) *Dysdercus supersticiosus*, *F.* Cotton Stainer. Stainers migrated into the crop during September or early October, usually breeding and remaining in the crop until harvest. At Samaru, Daudawa and Gusau populations were small, the heaviest incidence occurring at Kontagora and Gombe.

At Samaru several adults of *Dysdercus fasciatus*, Sign. were found amongst large numbers of *D. supersticiosus* on 'rama' (*Hibiscus cannabinus*) during October. *D. fasciatus* was found on cotton at Kontagora, where it also occurred on baobab trees, though not with *D. supersticiosus*.

(6) *Mirid Damage*.—Tattering caused by mirids was again widespread in all cotton growing areas, but the extent of the damage was very variable and at a lower level than last year.

(7) *Crop Loss*.—Heaviest shedding was recorded at all stations during November, and bollworm damage to shed buds and bolls, and ripe bolls is given in Table 87.

TABLE 87.—PERCENTAGE DAMAGE BY BOLLWORMS TO SHED BUDS, SHED AND ABORTED BOLLS, AND TO RIPE BOLLS, 1954-55
(Figures for 1953-54 in brackets)

Station	Shed Buds	Shed and Aborted Bolls	Ripe Bolls
Samaru ...	35 (26)	12 (15)	28 (27)
Daudawa ...	52 (42)	23 (26)	39 (30)
Gusau ...	72 (57)	63 (42)	42 (37)
Gombe ...	44 (41)	43 (36)	21 (56)
Kontagora ...	37 (40)	35 (45)	89 (69)

An analysis of damage to ripe bolls is given in Table 88. The percentage of clean locks at Kontagora and in Numan Division of Adamawa Province was very low compared with other stations.

A discussion on the estimation of crop losses due to insects and pests follows in the section on Insecticide Trials.

TABLE 88.—PERCENTAGE LOCK DAMAGE IN RIPE BOLLS

Station	Clean	Bollworm Partial Loss	Bollworm Total Loss	Non Boll- worm partial Loss	Non Boll- worm Total Loss
Samaru ...	75	5.5	1.5	14	4
Daudawa ...	68	8	7	15	2
Gusau ...	66.5	6.5	5.5	15	6.5
Gombe ...	64	7	2	22	5
Kontagora	23.5	25.5	27.5	20	3.5
Gusau Peasants (Mean of 4)	60	9.5	6.5	16.5	8
N. Adamawa Peasants (Mean of 4)	60	8.5	5.5	17.5	8.5
Numan Divi- sion Peasants (Mean of 6)	30.5	12	24.5	21	21

INSECTICIDE TRIALS ON COTTON, 1954-55.

Six insecticide trials on cotton were carried out during the season. At Samaru and Daudawa the application of insecticides did not produce any marked increases in yield compared with untreated cotton; at Kontagora the results were more promising, and indicate the need for further trials in this area.

1. *Samaru*.—(a) Two strips, each of 95 ridges by 12 yards, of a cotton multiplication area were sprayed with D.D.T. at the rate of 1 lb. D.D.T. per acre on 22-9-54, 2-10-54 and 20-10-54, and at the rate of 2 lb. per acre on 3-11-54 and 18-11-54. Adjacent strips were left as controls.

Counts taken on five dates between 22-9-54 and 18-11-54 showed that mirid damage was low on treated and untreated cotton; damage was reduced by a quarter on the sprayed strips. Boll samples taken on 16-11-54 showed that bollworm attack was also at a low level, less than 8% of green bolls on the plants in the trial area being damaged. Spraying had practically no effect on bollworm damage.

Yields over this multiplication area averaged 766 lbs. seed cotton per acre, and no obvious difference between sprayed and unsprayed strips was indicated.

(b) In a replicated trial on *barbadense* cotton, sprayed plots received 1.1 lb. D.D.T. per acre on 20-9-54, 30-9-54 and 12-10-54, and 2.2 lb. per acre on 25-10-54, 9-11-54 and 24-11-54.

Two varieties of *barbadense*, BAR 4/16 and BLR 14/25, were included in the trial; in addition to attack from bollworms and mirids, this type of cotton is liable to suffer severe jassid damage. Jassid counts taken on 17-9-54 gave 74 adults per 100 leaves; later counts showed a much smaller population over the whole area of the trial. A comparative score for jassid damage, estimated on 17th November, is given for each variety of *barbadense* in Table 89.

Mirid damage was low, but by the end of October a moderate degree of control was achieved, tattering on the sprayed plots being reduced to 43% of that on the untreated plots. There was no difference between the two varieties of cotton.

Final yields are given in Table 89.

TABLE 89.—SAMARU INSECTICIDE TRIAL ON BARBADENSE COTTON
Comparative Jassid damage, and yields in lb./acre

	BAR 4/16		BLR 14/25	
	<i>Jassid damage</i>	<i>Yield</i>	<i>Jassid damage</i>	<i>Yield</i>
Sprayed ...	60	241	44	282
Unsprayed ...	100	206	100	285

2. *Daudawa*.—(a) A block of approximately eight acres of Stage B multiplication cotton was dusted with hand operated machines on 14-10-54, 28-10-54 and 12-11-54. The insecticide used was a cotton dust containing 10% D.D.T. and 3% gamma B.H.C., and it was applied at the rate of 28 lb. per acre on each date.

Samples taken on 13-11-54 indicated that 28% of green bolls were damaged by bollworms in the dusted area. A smaller proportion (21%) was damaged in an adjacent area of Stage C cotton, which was planted three weeks later than Stage B.

No statistical comparison of yields from dusted and undusted cotton can be made, but examination of yields from other parts of the multiplication area shows that dusting did not give any obvious increase (Table 90).

TABLE 90.—DAUDAWA COTTON MULTIPLICATION

Yields in lb/acre

<i>Field</i>	<i>Area</i>	<i>Date planted</i>	<i>Yield per acre</i>	
12 (Stage B)	8 acres	29/6/54	334	Dusted.
18 (Stage C)	20 acres	19/7/54	332	Adjacent to field 12.
4 (Stage B)	18 acres	30-31/6/54	437	—
3 (Stage C)	18 acres	1-2/7/54	460	Adjacent to field 4.

(b) A block of two acres of cotton on the multiplication farm at Shemi was sprayed with 1lb. D.D.T per acre on 15-9-54, 24-9-54, 5-10-54, 14-10-54 and 28-10-54. The treatments were applied at the period of the heaviest mirid attack using battery knapsack sprayers.

The area of the trial was only moderately damaged by mirids before spraying began; by the middle of October spraying had reduced this by nearly half. Bollworm damage to green bolls on the sprayed area (9%) was also about half of that on unsprayed cotton (19%).

In spite of the reduction in mirid and bollworm damage the yield of the sprayed area at 333 lb. per acre was little more than the 310 lb per acre obtained from an equivalent area of unsprayed cotton.

3. *Kontagora*.—(a) A replicated trial covering four acres was laid down on Kontagora Land Settlement Scheme. A spray mixture containing 0.5% D.D.T. and 0.15% gamma B.H.C. was applied at 40 gallons per acre on 30-9-54, 14-10-54, 28-10-54, 16-11-54, 1-12-54 and 15-12-54. The cotton on the farm was sown late in the season, part on 15th August, and part on 12th September.

Green boll samples examined on 25-11-54 did not reveal any marked difference in damage by bollworms between sprayed and control plots. There was some indication that on the August sown plots, spraying had resulted in more bolls remaining on the plants. Over the whole trial bollworms had attacked less than 10% of all the green bolls examined.

Yields of seed cotton for both sowing dates are given in Table 91.

TABLE 91.—KONTAGORA LAND SETTLEMENT SCHEME INSECTICIDE TRIAL
Yields in lb per acre

	<i>Sown 15-8-54</i>	<i>Sown 12-9-54</i>
Sprayed	277 (142%)	199 (119%)
Unsprayed	195 (100%)	167 (100%)

(b) On Kontagora Farm Centre the whole of a "Date of Sowing, Spacing and Manurial Trial of Cotton" was sprayed with an insecticide mixture similar to that used on the Settlement Scheme. The dates of application were: 15-9-54, 29-9-54, 13-10-54, 27-10-54, 10-11-54 and 24-11-54. A similar trial was planted and left unsprayed to serve as a comparison. While this arrangement prevented any interference with the unsprayed trial by insecticide, differences in yield between the two experiments could have been caused by effects other than the spray treatments. These differences were, however, so marked, that it seems reasonable to attribute them largely to the effect of the insecticide.

Boll samples taken from all plots of one replicate in the manured and unmanured half of each trial show that the main effect of the spraying was to increase the number of bolls remaining on the plants, rather than to reduce the proportion of damaged bolls (Table 92).

TABLE 92.—KONTAGORA FARM CENTRE. INSECTICIDE TRIAL
Boll samples taken on 16th November from 5 stands per plot

	<i>Sprayed Trial</i>		<i>Unsprayed Trial</i>	
	<i>Manured</i>	<i>Unmanured</i>	<i>Manured</i>	<i>Unmanured</i>
Total Bolls	415	297	238	124
Undamaged Bolls ...	146	149	122	77
Percentage Undamaged ...	35	50	51	62

Final yields from both trials are given in Table 93, and detailed analysis of each trial reveals the following points:

- (i) The yields from different levels of fertility were only significantly different ($P=1\%$) in the sprayed trial. When fertiliser trials on cotton are held in areas where insect damage is likely to be heavy, the effect of pest interaction should be taken into account when the results are considered.
- (ii) Yields from different sowing dates were significantly different in the sprayed trial ($P=0.1\%$) and in the unsprayed trial ($P=1\%$). This is in line with results obtained elsewhere in the Northern Region, though the mid-June sowing date does not always out-yield early July.
- (iii) Yields from the three different spacings were significantly different in the sprayed trial ($P=1\%$) and in the unsprayed trial ($P=5\%$). The tendency of the closer spacing to give higher yields requires further investigation. Trials held over a number of years at Samaru and Daudawa have shown that in these areas yields from all three spacings are similar.

The results of the trials at Kontagora clearly demonstrate that the highest increases in yield following the use of insecticides come from cotton growing under optimum conditions. The cotton plant should be capable of producing a reasonable yield in the absence of pests; low yields resulting from late planting or lack of fertility cannot be compensated for by using insecticides.

INSECTICIDE AND SEED-DUSTING TRIALS —GENERAL CONSIDERATIONS

The loss in yield from the cotton plant following insect attack may be due to:

- (a) Direct or indirect damage causing shedding of fruiting points which cannot be replaced by the plant in time for full development to occur.
- (b) Damage to bolls which remain on the plant. These bolls may abort, fail to open normally or show varying degrees of lock damage if splitting takes place.

In the main cotton growing areas of Northern Nigeria both kinds of loss can be caused by bollworms and stainers; in addition the first type can be induced by mirids feeding on very young fruiting points. Malformation of the cotton plant following insect attack may result in fewer fruiting points being formed.

TABLE 93.—KONTAGORA FARM CENTRE

Yields in lb per acre seed cotton from *Sprayed Trial (A)* and *Unsprayed Trial (B)**Dates-of-Sowing*

d₁—20-6-54
 d₂—11-7-54
 d₃—1-8-54
 d₄—22-8-54

Spacing

s₁—9 inches
 s₂—18 inches
 s₃—27 inches
 (on 3 feet ridges)

Manure

The manured parts received:
 3 tons/acre f.y.m.,
 112 lb/acre superphosphate and
 56 lb/acre Sulphate of Ammonia

		MANURED				UNMANURED				GRAND MEAN
		S ₁	S ₂	S ₃	MEAN	S ₁	S ₂	S ₃	MEAN	
A	d ₁	690	511	380	530	261	227	225	238	384
B		187	161	99	149	68	62	46	58	104
A	d ₂	268	333	266	289	205	209	171	195	242
B		74	64	57	65	85	66	91	81	73
A	d ₃	186	150	126	155	85	88	112	95	124
B		69	71	95	78	71	61	53	62	70
A	d ₄	100	69	55	75	21	23	33	26	51
B		25	28	22	25	36	29	25	30	27
A	MEANS	311	268	207	262	143	137	138	139	200
B		89	81	68	79	65	55	54	58	69

The total number of fruiting points initiated by the plant under reasonable growing conditions is usually so high that a large proportion is shed even in the absence of insects. It is probable that if insects are to influence total seasonal shedding, the total number of fruiting points lost must exceed the number that would be lost through physiological causes alone. If this is not the case, control of the insects concerned will only result in a lower proportion of insect damaged sheds, but will not reduce the total number of sheds. Unless the damage to non-shedding bolls is reduced, there will be little difference in the final yield; the crop may mature earlier, but this is of little consequence in a normal season.

This is a simplification of a complex problem; the relative importance of physiological and insect-induced shedding will vary throughout the season according to the interaction between three variables: (a) the rate of fruiting point production, (b) the rate of physiological shedding, and (c) the variation in intensity of insect attack. The period when insect-induced shedding is most likely to assume dominance is when the flush of fruiting-point production is over, and when the time is approaching beyond which it is too late for further fruiting points to mature. A low level of insect attack at this time could well be more damaging than a higher level of attack at the peak of fruit initiation.

At Samaru during the past two seasons the level of insect attack was apparently not high enough for control to increase the number of non-shedding bolls on the plant. (See Table 94 and details of Samaru Insecticide Trial in Annual Report for 1953-54).

TABLE 94.—SAMARU INSECTICIDE TRIAL, MULTIPLICATION AREA, 1954-55
Analysis of Boll Samples taken on 16th November

	<i>Aborted Bolls</i>		<i>Ripe Bolls</i>		<i>Green Bolls</i>		<i>Total Bolls</i>	<i>Percentage Damaged by B.W</i>
	<i>Total</i>	<i>Damaged</i>	<i>Total</i>	<i>Damaged</i>	<i>Total</i>	<i>Damaged</i>		
Control Strips (190 Plants)	488	230	151	63	2,305	176	2,944	15.8
Sprayed Strips (180 Plants)	414	197	189	75	2,396	163	2,999	14.7

Any increase in yield could only be produced by a reduction in damage to non-shedding bolls; lack of control of the insects concerned is reflected in the absence of any marked increase. At Kontagora shedding in excess of what would have occurred solely from physiological causes was induced by insects, and control of these has resulted in more bolls remaining on the plant. (Table 92). This is the main reason for the observed yield increase, since damage to the bolls remaining on the plant was not greatly reduced. It is evident that the prevention of damage to non-shedding bolls by bollworms is a problem that has not yet been satisfactorily solved, and further trials using insecticides other than D.D.T. and B.H.C. are planned.

An explanation on similar lines would account for the absence of yield increases following the use of acid-treatment or seed-dusting for the control of bacterial blight reported on pages 98-100. If the incidence of the bacterial blight on the control plots, sown with the partially resistant commercial strain, was such that losses to fruiting points in the early stages of growth were compensated for by the plant, any reduction by dusting or acid-treatment would not lead to an increase in the number of non-shedding bolls. The spread of the disease later in the season from control to treated plots would give fairly uniform symptom counts over the whole trial, and whether or not these symptoms were correlated with damage to ripe bolls, no significant differences in total yield could be expected.

The argument for seed-treatment can be restated in two parts, as follows ;

(a) Death of seedlings or shedding of excessive numbers of fruiting points from bacterial blight can be prevented by seed-treatment irrespective of the area treated. Significant increases in yield from dusted seed, compared with untreated seed, can be demonstrated in replicated trials if strains of cotton of low resistance to bacterial blight are used, or in years when the disease is particularly severe. In some, and probably the majority of seasons, with the strain of cotton now in use, the compensating powers of the plant can overcome any losses in fruiting points caused by the disease. Seed treatment to prevent damage during the early stages of development of the cotton plant is therefore more in the nature of an insurance against possible loss in years when conditions are especially favourable to bacterial blight.

(b) Although symptoms of bacterial blight are frequently found in the commercial crop, no detailed estimates of loss in yield due to damage to non-shedding bolls has been attempted. It is fairly certain that this loss does occur, and if seed treatment is to be used at all to prevent it, treatment should be on the widest possible scale to avoid spread of the disease from undusted to dusted cotton. It is unlikely that this conclusion could be confirmed by small scale replicated trials.

ESTIMATION OF LOSSES CAUSED BY INSECTS AND DISEASES

Experimental determination of the loss caused by insects and diseases to the cotton crop in Northern Nigeria is complicated by the powers of recovery of the cotton plant, and by the difficulty of growing it under reasonably natural conditions with all interference by insects and diseases eliminated. As the conditions in which the cotton is grown (for example, date of sowing, fertility level and climate) also profoundly influence the extent of damage it is unlikely that any exact figure can be obtained; the following estimations can only be regarded as approximate.

Loss may be quantitative or qualitative. The importance of quantitative loss will depend on its magnitude; the importance of qualitative loss, which is reflected in the grade of the crop, will vary with the standard of the grades adopted, and the price paid for them. A low price differential

between grades that are widely different in quality will minimise the importance of qualitative loss, and a big price differential combined with high grading standards will have the opposite effect.

It has been suggested in the previous section that the greater part of the loss to the cotton crop directly attributable to insects and disease at Samaru and Daudawa in some seasons results from damage to non-shedding bolls. This damage may manifest itself in a variety of ways:

(a) Boll development may be arrested at some stage, the boll becoming aborted and incapable of splitting. Not all aborted bolls are produced as a result of insect or disease attack; physiological abortion, as well as physiological shedding, occurs. Some examples of the proportions of aborted bolls amongst non-shedding bolls is given in Table 95. Until a more precise evaluation of the extent and cause of this type of loss is made, it is assumed that about 5 per cent of non-shedding bolls abort because of insects or disease.

TABLE 95.—PERCENTAGES OF ABORTED BOLLS AMONGST NON-SHEDDING BOLLS AT HARVEST

Samaru	...	...	1953-54	8.5%
			1954-55	5.6%
Daudawa	...	...	1953-54	14.8%
			1954-55	7.1%
Gusau	...	...	1953-54	4.5%
			1954-55	5.1%
Gombe	...	...	1953-54	28.8%
			1954-55	12.5%
Kontagora	...	...	1953-54	9.4%
			1954-55	22.6%

(b) The boll may split, and all or some of its locks may be rendered unpickable; these together with aborted bolls, are a source of quantitative loss to the crop.

(c) The boll may split, and all or some of its locks be partially damaged; these locks can be picked, but they will weigh less than undamaged locks particularly if seed development is interfered with. In these calculations the weight of damaged locks is taken to be half that of undamaged locks. Loss will also be qualitative, the proportion of damaged locks mixed with clean locks determining the grade of the crop when sold.

An analysis of damage to split bolls is given in Table 96, which is based on records similar to those in Table 88, over a period of three or four years. (The classes of damage are described in Emp. Cotton Grow. Corp., Reps. Expt. Stns., Northern Nigeria, 1951-52).

TABLE 96.—ANALYSIS OF DAMAGE TO SPLIT BOLLS

Station	No. of Yrs' Records	No. of locks		Pickable Cotton			
		Pickable (Clean and partially damaged)	Not pickable (Total loss locks)	No. of Clean locks	No. of Partially Damaged locks	Wt. of Clean locks	Wt. of Partially Damaged locks
Samaru ...	4	89	11	77	23	87	13
Daudawa	4	89	11	76	24	86	14
Gusau ...	3	88	12	62	38	77	23
Gombe ...	4	86	15	67	33	80	20
Kontagora	4	69	31	41	59	58	42

N.B.—All figures are expressed as percentages; the weight of partially damaged locks is assumed to be half that of undamaged locks.

From these figures the total loss in yield at Samaru and Daudawa due to insect and disease attack on non-shedding bolls is roughly 25 per cent of the potential yield. In addition, of the cotton that is picked, between 12 and 15 per cent by weight is damaged. Losses at Gombe and Gusau are somewhat higher.

At Kontagora the position is quite different. Here the number of non-shedding bolls is greatly reduced because of the high incidence of insect pests and disease, and there is a larger proportion of aborted bolls. Amongst the split bolls, 30 per cent is unpickable, and 40 per cent by weight of the picked cotton is partly damaged. For these reasons, the actual yield of cotton sown in early July at Kontagora Farm Centre last season, was probably less than a fifth of the total potential yield.

PART VII.—GRASSLAND SECTION

BY A. BLAIR RAINS

INTRODUCTION

Work on Pasture Research was hampered by leave arrangements during the year. Plans have been made to transfer this section from Samaru to the Stock Farm, Shika, five miles away where there is much more land available for pasture experiments. The work will continue to be directed as a section of the Northern Research Station.

EXPERIMENTAL WORK

(1) *Comparison of Cutting Treatments.*—The experiment on Annual Grasses referred to in the 1953-54 report has been completed. The grasses were *Pennisetum pedicellatum* strain 10, *Rottboellia exaltata* and a fodder *Sorghum*; *Chloris gayana* was introduced to compare the behaviour of a perennial grass.

Cutting treatments were (a) one cut eleven weeks after planting and the aftermath subsequently cut ten weeks later and (b) two cuts, one seven weeks after planting and the second ten weeks later. It should be mentioned that it was not originally planned to take any aftermath. Yields of dry matter and crude protein are given in tables 97 and 98.

TABLE 97.—COMPARISON OF TREATMENTS
Yields in lbs D.M. per acre

Weeks after Planting	11	21	7	17	
Species	Cut	Aftermath	Total	1st Cut	2nd Cut
Pennisetum pedicellatum	4,670	3,180	7,850	270	8,080
Rottboellia exaltata	7,060	1,390	8,450	2,110	3,880
Sorghum	5,997	1,358	7,355	1,828	3,952
Chloris gayana	3,156	3,154	6,310	320	4,790
Mean*	5,221	2,271	7,491	1,149	5,176
					6,325
					8,100
					7,220
					6,568
					5,745
					6,908

S.E. of Mean of Species ...
S.E. of Mean of Treatments ...
S.E. of four plots ...
5 per cent Sig. Diff. ...

TABLE 98.—COMPARISON OF TREATMENTS
Yields in lbs Crude Protein per acre and C.P. as a % Dry Matter

Species	Cut	Aftermath	Total	1st Cut	2nd Cut	Total	Mean
	lb.	%	lb.	%	lb.	%	lb.
P. pedicellatum	345	7.3	96	3.1	441	5.5	58
R. exaltata	241	3.4	53	3.8	294	3.5	282
Sorghum	285	4.8	78	5.7	363	4.9	307
C. gayana	314	9.5	84	2.7	398	6.3	59
Mean	396	6.3	78	3.8	374	3.1	177
							237
							4.7
							4.7
							4.2
							5.3
							5.6
							7.3
							5.3
							5.9

S.E. of Mean of Species ...
S.E. of Mean of Treatment ...
S.E. of four plots ...
1 per cent Sig. Diff. ...

The two massive grasses *Sorghum* and *Rottboellia* produced more dry matter in one cut at eleven weeks than in two cuts at seven and seventeen weeks, but gave an appreciably higher yield of crude protein in the two cuts than they did in the one cut, or in the one cut plus the aftermath. The *Chloris* and *Pennisetum* which have smaller seeds were slower starting but were more flexible in terms of recovery after cutting. The productivity of the *Chloris*, a perennial in its first year, compared with the other grasses was high.

Root samples were taken from the plots and the weights are given in table 99.

TABLE 99.—COMPARISON OF CUTTING TREATMENTS

				Root weights in lbs per acre		
Species				Cut and Aftermath	Two Cuts	Mean
Pennisetum	pedicellatum	...		304	245	275
Rottboellia	...	...	...	126	208	167
Sorghum	...	...	...	274	172	223
Chloris	gayana	...	...	244	275	260
Mean				237	225	231

S.E. of Means of species ± 38.3

S.E. of Treatment Means ± 27.1 Not Significant.

The root systems of *Chloris* and *Pennisetum* were much finer and more branched than those of *Sorghum* and *Rottboellia*.

(2) *Optimum Spacing of Grasses*.—Four grasses, *Cenchrus ciliaris*, *Chloris gayana*, *Pennisetum polystachyon* and *Andropogon gayanus* were sown (a) as spaced plants 18"x18", (b) in continuous rows 18" apart and (c) broadcast as a sward.

TABLE 100.—SPACING EXPERIMENT SEED RATES IN LBS PER ACRE

	<i>Cenchrus ciliaris</i>	<i>Chloris gayana</i>	<i>Pennisetum polystachyon</i>	<i>Andropogon gayanus</i>
Spaced	0.25	0.25	0.3	1
Rows	3.20	3.20	7.5	25
Sward	16.0	13.0	21.0	75

Two of the grasses, *Pennisetum* and *Andropogon*, are of the large erect tussock type, while the *Chloris* and *Cenchrus* are more prostrate and spreading. No application of manure or fertiliser has been given. The plots are cut with an autoscylthe and the cut material is removed.

The experiment was sown in June 1953 and in two seasons has been cut four times. Yields of dry matter, P₂O₅, crude protein and soluble carbohydrate are given in tables 101 to 104. These are totals for the 4 cuts over the two years.

TABLE 101.—SPACING EXPERIMENT

Dry Matter in lbs per acre

	<i>Cenchrus</i>	<i>Chloris</i>	<i>Pennisetum</i>	<i>Andropogon</i>	<i>Mean</i>
Spaced	4,579	7,173	8,185	8,908	7,211
Rows	5,415	7,784	7,207	9,849	7,564
Sward	3,444	7,871	3,853	7,733	5,725
Mean*	4,479	7,609	6,415	6,630	6,833

S.E. of Mean of Species ± 745 5% Sig. Diff. 2383
 S.E. of Mean of Species ± 1023 5% Sig. Diff. 2986
 S.E. of 4 plots (Interaction) ± 2046

TABLE 102.—SPACING EXPERIMENT

P₂O₅ Lbs per acre and as % Dry Matter

			<i>Cenchrus</i>		<i>Chloris</i>		<i>Pennisetum</i>		<i>Andropogon</i>		<i>Mean</i>	
			<i>lb.</i>	<i>%</i>	<i>lb.</i>	<i>%</i>	<i>lb.</i>	<i>%</i>	<i>lb.</i>	<i>%</i>	<i>lb.</i>	<i>%</i>
Spaced	...	...	16.76	0.37	17.96	0.25	16.08	0.20	20.99	0.24	17.95	0.27
Rows	...	...	16.99	0.31	17.56	0.25	17.38	0.24	20.42	0.21	18.09	0.25
Sward	...	...	11.95	0.35	22.69	0.29	11.65	0.30	19.81	0.25	16.53	0.30
Mean	...	...	15.23	0.34	19.40	0.26	15.04	0.25	20.41	0.23	17.52	0.27

S.E. of Mean of Species ± 3.64 lbs.
 S.E. of Mean of Spacing ± 1.16 lb.
 S.E. of 4 plots (Interaction) ± 2.32 lb. 5% Sig. Diff. = 6.77 lb.

TABLE 103.—SPACING EXPERIMENT

Crude Protein lbs per acre

	<i>Cenchrus</i>	<i>Chloris</i>	<i>Pennisetum</i>	<i>Andropogon</i>	<i>Mean</i> **
Spaced	225	306	284	409	306
Row	317	359	310	404	348
Sward	180	268	159	336	236
Mean*	241	311	251	383	297

S.E. of Means of species ± 30.4 lb 5% Sig. Diff. 97.2 lb.
 S.E. of Means of spacing ± 18.9 lb. 1% Sig. Diff. 74.8 lb.
 S.E. of 4 plots ± 37.9 lb.

TABLE 104.—SPACING EXPERIMENT

Soluble Carbonhydrate lbs per acre

	<i>Cenchrus</i>	<i>Chloris</i>	<i>Pennisetum</i>	<i>Andropogon</i>	<i>Mean**</i>
Spaced	1911	3124	2503	4163	2925
Rows	2152	3547	3000	4458	3289
Sward	1301	3594	1695	3531	2530
Mean **	1788	3422	2399	4051	2915

S.E. of Means of species ± 298 lb. 1% Sig. Diff. 1370 lb.S.E. of Means of spacing ± 130.5 lb. 1% Sig. Diff. 516 lb.S.E. of 4 plots ± 261 lb.

From the results it will be seen that the grasses differ significantly in their productivity and that spacing also has a considerable effect on their performance. The phosphate and nitrogen (crude protein) figures are assumed to be an indication of root development. Very considerable edge effects have appeared round the plots and from the analysis of similar edge effects on other non-experimental plots it seems probably that nitrogen is the principal factor involved; the roots of the outside plants have considerably more ground from which they can draw nitrogen.

(3) *Value of Nitrogen and Frequency of Cutting*.—An experiment has been started to investigate the value of sulphate of ammonia on grass in terms of dry matter and crude protein under different cutting frequency.

(4) *Effects of Burning*.—In an attempt to discover the significance and consequence of grass burning during the dry season, as is widely practised for the sake of the new growth, *Andropogon gayanus* was sown in 1953 as widely spaced plants. In the two succeeding dry seasons a number of these plants have been burnt. After the new growth has developed, the plants are removed, washed, weighed and analysed, unburnt plants of a similar size are treated in the same way and the figures have been compared.

While a technique is still being worked out in order to provide precise results a certain amount of information has been obtained. The amount of new growth appears to bear a fairly close relationship to the size of the root and crown and to the reserves contained by them. The nitrogen in the new leaf is drawn from the root and crown; the leaf also appears to draw on the root and crown for some of its carbohydrate material but also synthesises an appreciable amount. Why new growth is so restricted is uncertain, the level of nitrogen and other elements in the leaf is adequate to allow for further development. Water would appear the obvious limiting factor, especially in view of the water required by the young leaf in transpiration.

(5) *Natural Grass Management Studies*.—These observations are based on mowing, grazing and burning and combinations of the treatments at different times of the year. The same management is followed each year for a number of years. The study was commenced two years ago with initial stumping. Each paddock is of $1\frac{1}{4}$ acres and in each there is a large quadrat which receives superphosphate (2 cwt. per acre) annually.

An early mowing the rains appears to check scrub growth mainly *Isobерlinia doka* a late mowing is less successful. More frequent mowing will probably eliminate scrub completely. On an area receiving no treatment the grass is tall and coarse with a considerable mat of dead grass and appears to be restricting scrub growth. Burning at the beginning of the dry season favours the scrub at the expense of the grass and results in a much reduced ground cover, while a burn after the beginning of the rains is more favourable to the grass and provides a check to the scrub: the latter system does depend on preventing accidental fire during the dry season. The combination of one mowing and subsequent grazing each rains has resulted in the best cover and an attractive pasture.

The phosphate quadrats have encouraged a marked growth of several naturally occurring herbaceous legumes including *Indigofera echinata* and *Zornia diphylla*.

(6) *Visit of Pasture Mission*.—During the year the American Pasture Mission (F.O.A.) visited Nigeria, and after extensive touring produced their report. This describes the present condition of the natural grasslands of Nigeria and Cameroons, grazing practises and cattle movement.

APPENDIX I

NOMINAL ROLL OF ESTABLISHED STAFF 1-4-54—31-3-55

1.—ADMINISTRATION AND STATION MANAGEMENT

Senior Services:

- J. H. Gisborne, B.A., A.I.C.T.A., Acting Assistant Director of Agriculture (Research), 1-4-54—31-3-55.
 E. J. Butler, B.A., Acting Principal Research Officer, 8-9-54—31-3-55.
 D. J. Iddon, Agricultural Superintendent, Station Manager, 1-4-54—16-11-54.
 J. R. Turner, Development Officer, Station Manager, 3-2-55—31-3-55.

Junior Service Clerical:

- I. I. Ekweonu, Assistant Chief Clerk
 M. O. Pearce, 1st Class Clerk—transferred 19-2-55
 U. Iroha, 1st Class Clerk—arrived 31-3-55
 D. O. Osuoji, 1st Class Clerk—transferred 17-11-54
 P. O. Ochei, 2nd Class Clerk
 E. A. Ogoro, 2nd Class Clerk
 E. C. Ijoma, 3rd Class Clerk
 M. M. Bassey, 3rd Class Clerk
 I. Etta, 3rd Class Clerk—transferred 14-12-54
 U. Kalu, Clerical Assistant
 J. N. Achime, Clerical Assistant
 N. O. Kano, Clerical Assistant
 J. O. Nwokedi, Clerical Assistant
 S. N. Dama, Clerical Assistant

Junior Service Technical:

- Nuhu Kontagora, Assistant Agricultural Officer, Grade III—transferred 7-7-54
 O. Ikwan, Assistant Agricultural Officer, Grade III—transferred 25-7-54
 S. O. Abodunde, Assistant Agricultural Officer, Grade III—left on Scholarship 3-6-54
 W. Samaila, Senior Agricultural Assistant—arrived 27-11-54
 O. A. Inyang, Senior Agricultural Assistant—transferred 14-4-55
 H. I. Chidebe, Field Overseer, Grade II
 S. J. Aleriwa, Field Overseer, Grade II

Junior Service—Artisans, etc.

- I. E. Obi, Mason
 J. A. Ukwu, Motor Driver
 E. Irunato, Motor Driver
 U. Achomadu, Motor Driver—appointment terminated 23-8-54
 E. Nwani, Motor Driver—arrived 15-12-54
 S. Ekundayo, Motor Driver—transferred 2-12-54
 Ojo Oturkpo, Motor Driver—appointed 8-2-55

Junior Service—Messengers, etc.

- Okon Umoh, Telephone Attendant
 C. O. Chief, Messenger
 Alilu Zaria, Messenger

Junior Service—Messengers, etc—continued.

D. D. Dzer, Messenger
 J. E. Obani, Messenger
 D. O. Inyamah, Messenger
 Mazu Hausa, Messenger

2.—AGRONOMY SECTION

Senior Service:

J. K. Obi, Acting Agricultural Superintendent 1-4-54—14-9-54
 D. C. Pickering, B.Sc., Agricultural Officer, (Agronomist) 25-8-54—31-3-55
 P. T. Nelson, B.Sc., Agricultural Officer, (Agronomist) —arrived 23-2-55

Junior Service Technical:

J. K. Obi, Assistant Agricultural Officer, Grade I
 F. U. Onyejekwe, Senior Agricultural Assistant
 S. O. S. Nwokeabia, Assistant Agricultural Officer, Grade III
 U. I. Offia, Agricultural Officer, Grade III
 C. N. Orji, Agricultural Assistant, Grade III
 F. C. K. Atuora, Agricultural Assistant, Grade III
 I. O. E. Emeruwa, Agricultural Assistant, Grade III
 Garba Tafawa, Agricultural Assistant, Grade III
 I. A. Tagbo, Agricultural Assistant, Grade III— arrived 21-4-54, resigned 6-1-55
 E. A. Uyire, Field Overseer, Grade I—dismissed 4-2-55
 A. A. Agbakwuru, Field Overseer, Grade II
 B. O. Illoh, Field Overseer, Grade II
 C. Agbo, Field Overseer, Grade II

3.—BOTANY SECTION

Senior Service:

A. R. Maurer, B.S.A., M.Sc., Botanist 1-4-54— 18-11-54
 Elizabeth Harrison, B.Sc., D.Ag.Sc., D.T.A., Botanist
 W. R. Wilson, Specialist Assistant (Laboratory Superintendent)
 C. W. Morgan, B.Sc. Production Officer

Junior Service:

B. O. Agbo, Assistant Agricultural Officer, Grade III
 T. O. Agulana, Agricultural Assistant, Grade II— transferred 2-4-54
 C. O. Oniyide, Agricultural Assistant, Grade II
 R. E. A. Asoro, Agricultural Assistant, Grade III— transferred 11-4-54
 C. C. U. Obidiozo, Agricultural Assistant, Grade III—transferred 5-4-54
 G. E. C. Mbonu, Agricultural Assistant, Grade III
 J. N. Iweala, Agricultural Assistant, Grade III—arrived 20-4-54 transferred 8-1-55
 F. B. Ndubuka, Agricultural Assistant, Grade III
 O. Nwaiwu, Agricultural Assistant, Grade III
 O. E. Ishie, Agricultural Assistant, Grade III
 Abdul Kaba, Agriculture Mal Assistant, Grade III— arrived 8-12-54
 J. T. Rogun, Agricultural Assistant, Grade III— arrived 21-5-54, transferred 7-11-54
 A. Udensi, Field Overseer, Grade II
 U. O. Agbaeze, Field Overseer, Grade II

Junior Service :—continued

P. N. W. Ezeuka, Field Overseer, Grade II
 S. O. Osokpor, Field Overseer, Grade II
 J. U. Nwajagu, Field Overseer, Grade II
 B. A. U. Okoh, Field Overseer Grade, II
 I. I. Uduma, Field Overseer, Grade II resigned 23-3-55
 O. O. Agwu, Field Overseer, Grade II—resigned 16-2-55
 E. J. Abayori, Field Overseer, Grade II
 J. N. A. Enyia, Field Overseer, Grade II
 J. U. Ekezie, Field Overseer, Grade II
 E. Okoronkwo, Laboratory Attendant
 Musa N. Mopah, Laboratory Attendant

Junior Service—Artisans etc.

B. O. Ugwu, Artisan Grade III (Photographer)

4.—CHEMISTRY SECTION

Senior Service:

H. Irving, B.S.A., Agricultural Chemist 1—3-4-54, 10-8-54—31-3-55
 G. M. Higgins, B.Sc., D.Ag.Sc., D.T.A., Agricultural Chemist 1-4-54—31-3-55

Junior Service—Technical:

O. T. Eshett, Agricultural Assistant, Grade II
 E. A. Okoruwa, Agricultural Assistant, Grade III
 S. A. Babalola, Agricultural Assistant, Grade III
 L. I. Bosah, Agricultural Assistant, Grade III
 P. O. Ukaga, Agricultural Assistant, Grade III
 S. Obaju, Agricultural Assistant, Grade III, left on Scholarship on 3-6-54
 V. A. Obafemi, Field Overseer, Grade II—resigned 7-1-55
 A. R. Akpan, Laboratory Attendant—appointment terminated 1-10-54
 F. O. Ochapa, Laboratory Attendant

Junior Service, Artisans, etc:

J. Ajayi, Electrician

5.—COTTON SECTION

Senior Service (all officers of the Empire Cotton Growing Corporation)

H. E. King, B.Sc., Dip. Agric., Cotton Breeder, 1-4-54—13-7-54, 21-9-54—31-3-55
 D. A. Lawes, B.Sc., Cotton Breeder, 1-4-54—8-3-55
 M. A. Choyce, B.Sc., D.S.O., Entomologist, 10-8-54—31-3-55
 M. G. Emsley, B.Sc., Entomologist, 28-7-54—31-3-55

Junior Service—Technical, Cotton Breeding:

F. Taskar, Assistant Agricultural Officer, Grade III
 F. O. Onwuralonye, Agricultural Assistant, Grade III
 S. N. P. Alisigwe, Agricultural Assistant, Grade III
 G. N. Okoli, Agricultural Assistant, Grade III—arrived 21-5-54
 I. S. Lado, Field Overseer, Grade II
 K. A. Ushie, Field Overseer, Grade II
 D. O. Iheonu, Laboratory Attendant

Junior Service—Technical, Entomology:

L. Akanle, Agricultural Assistant, Grade III, left on Scholarship on 3-6-54
 V. G. Sanda, Agricultural Assistant Grade III, left on Scholarship on 3-6-54
 Abdullahi Ibrahim, Agricultural Assistant, Grade III
 A. O. Nkwocha, Agricultural Assistant, Grade III
 E. U. Anazodo, Agricultural Assistant, Grade III
 R. O. Iregbu, Agricultural Assistant, Grade III
 A. O. U. Nnadi, Agricultural Assistant, Grade III
 A. M. Tiohn, Field Overseer, Grade II
 H. O. D. Umunna, Field Overseer, Grade II—dismissed 22-1-55
 F. A. Bepeh, Field Overseer, Grade II—resigned 4-9-54
 D. I. Jonah, Field Overseer, Grade II

6.—GRASSLAND SECTION

Senior Service:

A. Blair Rains, B.Sc., D.Ag.Sc., Grassland Officer, 1-4-54—1-5-54, 2-9-54—31-3-55

Junior Service, Technical:

E. E. Njoku, Agricultural Assistant, Grade II
 J. A. Yuwa, Agricultural Assistant, Grade III
 E. N. Ayinor, Agricultural Assistant, Grade III
 S. C. N. Okonkwo-Eje, Agricultural Assistant, Grade III—resigned 22-11-54
 J. A. Turton, Field Overseer, Grade II
 M. N. Atuonwu, Field Overseer, Grade II
 T. E. Oyibo, Laboratory Attendant
 Yakubu Dirisu, Laboratory Attendant

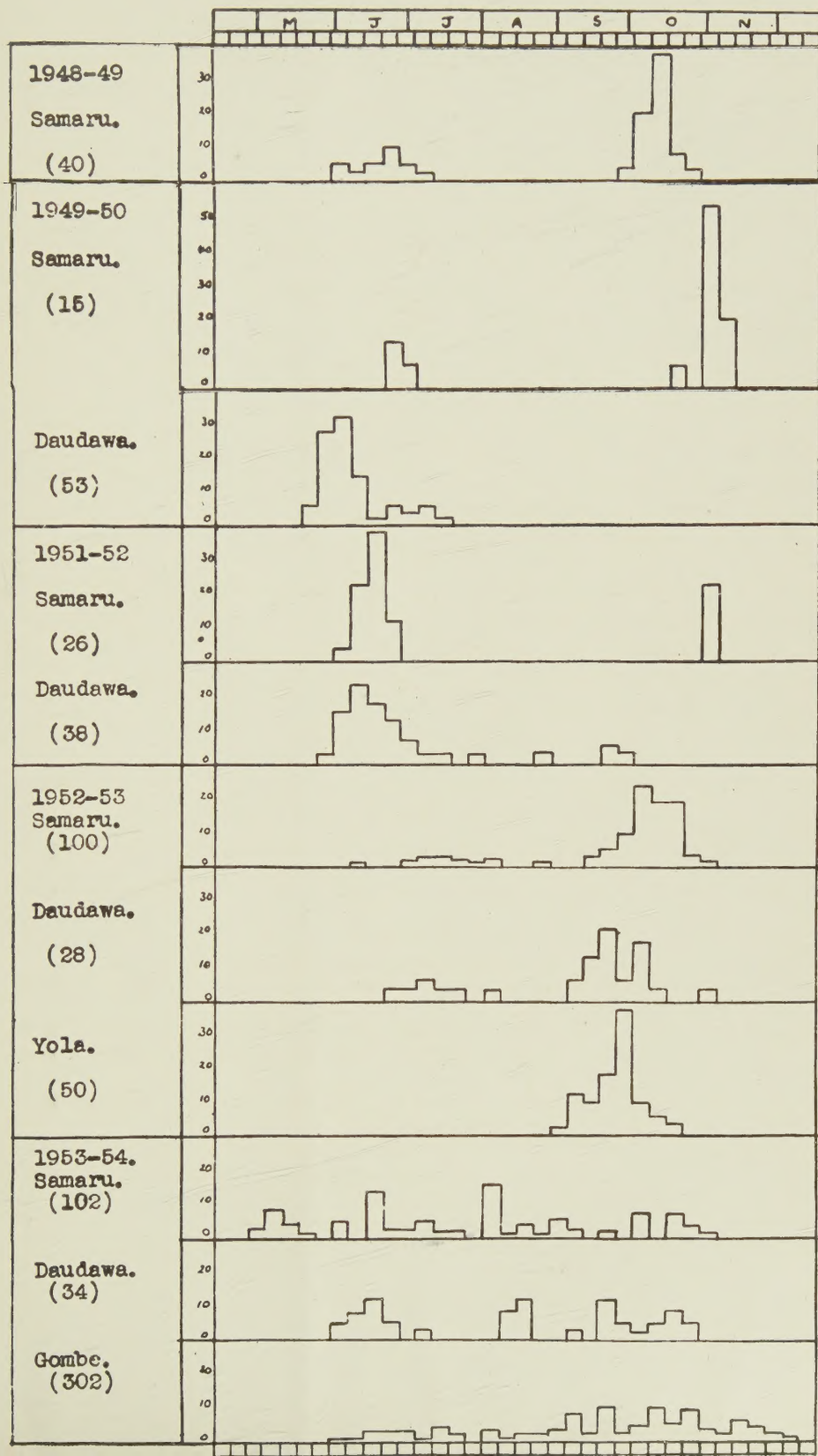
APPENDIX II

NAMES OF PLANTS IN COMMON USE IN NORTHERN NIGERIA

Acha	...	...	<i>Digiaria exilis</i> (staple grain of some hill tribes, particularly on Bauchi Plateau).
Benniseed	...	...	<i>Sesame</i> — <i>sesamum indicum</i> .
Cocoyam	...	...	<i>Colocasia esculentum</i> , <i>xanthosoma sagitifolium</i> .
Duro	...	...	<i>Pennisetum spicatum</i> , transplanted from nursery beds about July-August.
Gamba	...	...	<i>Andropogon Gayanus</i> (and occasionally <i>A. tectorum</i>) a large grass, used in planted fallows and found wild as climax species in much of the Region.
Gero	...	...	<i>Pennisetum typhoideum</i> , early planted, harvested at 4-4½ months.
Guineacorn	...	...	Species of grain <i>sorghums</i> .
Kyasawa	...	...	<i>Pennisetum pedicellatum</i> and other small <i>Pennisetums</i> .
Maiwa	...	...	<i>Pennisetum spicatum</i> : varieties differ from Dauro in being longer season (6 months) and never transplanted.
Millet	...	...	Normally means Gero (<i>P. typhoideum</i>).
Rama	...	...	<i>Hibiscus cannabinus</i> .
Rizga	...	...	<i>Coleus dazo</i> .
Tamba	...	...	<i>Eleusine corocana</i> , finger millet.
Tumuku	...	...	<i>Coleus dysentericus</i> .

HORIZONTAL SCALE: 7-day intervals, May to November.

VERTICAL SCALE: Number of moths emerging during 7-day interval, expressed as percentage of total number of moths emerging. This total and season when pupae were set are shown at left.



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